Electrical Review
WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 4. CHICAGO, SATURDAY, JULY 26, 1919.

Fig. 1.—Night View in a Spinning Room, Showing General Illumination Meeting All Requirements—Fixtures Can Be Easily Taken Down for Cleaning or Repairs, an Important Feature in a Cotton Mill.

Canadian Textile Mill Operated by Central-Station Service

Canadian Cotton Co.'s Plant Electrically Equipped Throughout — Remote Control and Other Features of Motor Service — Exceptionally Good General Illumination in Every Department

By V. K. STALFORD

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A VERY fine example is shown in the accompanying illustrations of a textile mill operated entirely from central-station service. It is the new plant of the Canadian Cotton Co., and is located in Hamilton, Ontario, Canada.

This mill manufactures all grades of cloth used for making overalls, mattresses, bed ticking, and light ducking. The building occupies an entire city block, about 300 ft. square and faces three streets. It is of mill type construction, three stories high. The total load is approximately 1000 kw., including lighting and power. This is an ideal load for central-station service. A number of the manufacturers in this territory had very great difficulty during the war in obtaining coal supplies and they are now contemplating central-station service to prevent recurrence of these difficulties.

The latest practice in the textile industry is to have all motors controlled entirely from a centrally located power house or substation, maintaining an operator at this substation at all times. The motors are only equipped with the emergency switches to permit disconnecting the same in case of accidents or other emergency. In this mill Detroit "Square D"

enclosed switches are used near the motors for this purpose.

In Fig. 2 a view in this substation is given, showing two rows of panels with starting switches for

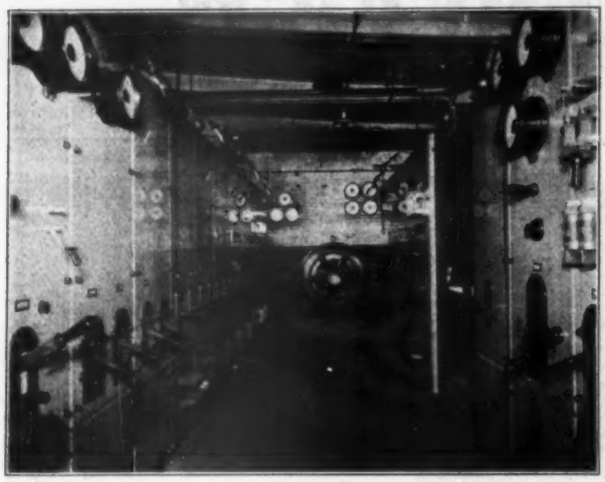

Fig. 2.—View in Central Substation, Showing Motor Control Panels and Distributing Boards—A 150-Hp. Motor Is Also Shown.

each motor and the necessary meters. A 150-hp. 220-volt, two-phase, 66⅔-cycle motor is shown in the center of the photograph for operating one of the weave rooms. The control for this motor is shown at the right of the picture. All the equipment in this substation was supplied by the Canadian Westinghouse Co., and installed by it. Each motor is started and stopped from this substation by the operator. Ammeters and voltmeters are used to give indications of the starting condition of each motor.

Fig. 3 is a rear view of the panels, showing the starting and running fuses. On the right-hand side of the illustration are shown the autotransformer coils with interlocking knife switches for rearranging the percentage taps of the autotransformers. This is a very compact installation. Sufficient space is provided at the rear of panels for making all necessary repairs.

Fig. 3.—Rear View of Motor Control Panels in the Central Substation, from Which Nearly All the Motors Are Controlled.

Samples of the electric lighting throughout this mill are given in four of the accompanying illustrations. These are considered excellent examples of modern textile-mill lighting. The management of this mill recognized that it is most important to have proper lighting facilities in order to reduce accidents during the hours of darkness and semidarkness. The

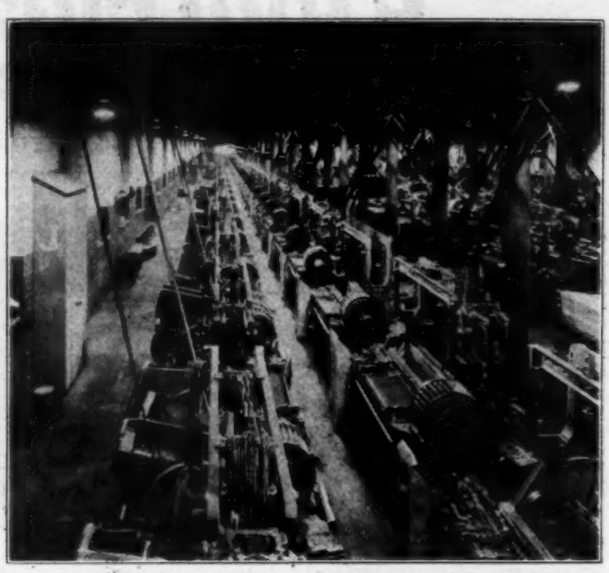

Fig. 4.—Night View in One of the Weave Rooms—Illumination That Has Been Found to Give Most Satisfactory Results.

factory lighting shown in these views will increase production, decrease cost, improve quality, reduce spoilage, and prevent accidents. In other words, it will not only improve production, but also conserve the human material in the textile industry which is its most valuable asset. The average time of artificial lighting in factories of this type is three hours per day. It is most important that the working conditions under artificial lighting should equal closely those of the best daylight at all working hours. This is more particularly true where night shifts are working.

Efficient lighting throughout the factory is equal to good tools. No foreman or superintendent would expect the workman to properly perform his task with poor tools. The workman and machinery are a combination and as such must work harmoniously. The

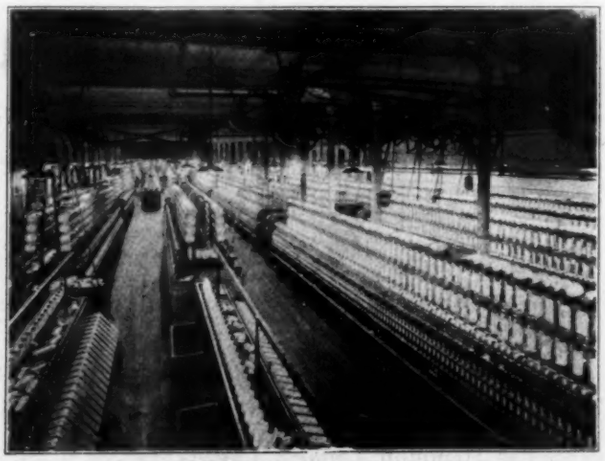

Fig. 5.—View in One of the Spinning Rooms—General Illumination That Floods the Whole Room in Light.

machine may be the best type that can be obtained, but with poor lighting the workman is handicapped, consequently the combination cannot produce satisfactory work to the highest efficiency. As the practice

now is to reduce working hours it will be necessary to increase production accordingly. It is the prime purpose of every plant to earn as much profit as possible; in fact, this is the reason for its existence. Therefore, if the manufacturer neglects to install proper illumination, he is taking cash from his pocket to pay for his own carelessness.

Fig. 6.—Inspectors' Tables Effectively Lighted to High Intensity so That Any Defect in the Cloth Can Be Detected Before Finishing and Shipping.

These ideas were given careful consideration before deciding on the lighting of this mill. In designing the installation thought was also given to the fundamental principles for lighting, which are: Correct intensity, good diffusion, lighting from the proper direction, absence of drop cords, and absence of glare, both direct and reflected.

Fig. 4 is a night view in one of the weaving rooms. The units in this room are 60-watt Mazda lamps in Benjamin deep bowl reflectors mounted approximately 7 ft. from the floor, located directly over the center of the machine. This has been found to give the most satisfactory results. The units at the rear of the machines are spaced approximately 15 ft. and 9 ft. from the floor. As these are only for general lighting purposes it is not necessary to have so great an amount of illumination at the rear of the machine.

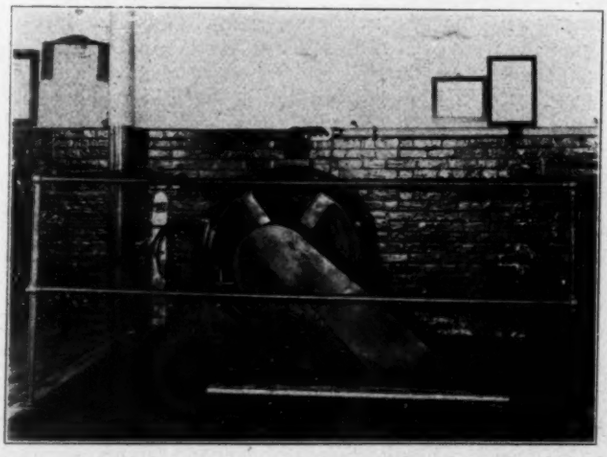

Fig. 7.—One of the Motors Connected to Drive a Group of Machines Through Silent-Chain Belt Drive.

In Fig. 5 is shown a view in one of the spinning rooms, using Benjamin shallow bowl reflectors of 60-watt size with 25-watt Mazda lamps and mounted 7 ft. from the floor.

In Fig. 1 another view is shown in the spinning rooms. The detail shown is very clear and there is a marked absence of confusing shadows. The fixture used throughout this mill is the Benjamin hanger with shock absorber suspended from the screw hook in the wooden ceiling. Reinforced cord is suspended between the outlet box and the fixture. Bryant type KA No. 13 receptacles are used in the outlet box for connecting the fixture plug; this provides a ready means for disconnecting the fixture so that it can be taken down for cleaning and repairs. This type of receptacle is very flexible for factory work.

Fig. 6 gives a view of the class of lighting used at the cloth inspection table where the final inspection is made of all of the cloth for defects before it is shipped to the customers. It is most important that this lighting should be as nearly perfect as possible in order that the inspector can find the defects. Benjamin 100-watt bowl reflectors with 60-watt Mazda C lamps are mounted approximately 3 ft. above the bench and on 6 ft. centers.

This lighting system has been in use for over one year, and the management is entirely satisfied with the excellent results obtained therefrom.

Fig. 7 is a typical installation of one of the motors with Link-Belt silent-chain drive enclosed and operating in oil. Group drive has been extensively used throughout the mill, using motors of 50 hp. and larger.

NEW POWER PLANT FOR PITTSBURGH DISTRICT.

Duquesne Light Co. to Erect Big Power House at Cheswick, Pa., to Serve Entire Pittsburgh District.

The Duquesne Light Co., Pittsburgh's central-station organization, has made arrangements for floating a $25,000,000 30-year bond issue, the bulk of the proceeds of which will be used for building a big new power plant at Cheswick, Pa., of such capacity that it can supply all of the electric power needs of the Pittsburgh district for an indefinitely long time in the future.

This plant will be along the Allegheny River within two miles of a 3000-acre thick-vein Freeport coal tract of the Equitable Coke Co., a subsidiary of the Philadelphia Co., which controls the Duquesne Light Co., thus assuring abundant supplies of water and fuel.

During the war a comprehensive survey was made by engineers of the War Department of Pittsburgh's probable power needs and it was estimated that the probable maximum demand was equal to 556,000 kw. The power plants of the Duquesne Light Co. have now a capacity of more than 156,000 kw.

Transmission lines will be erected to reach every vital part of the Pittsburgh district and to connect the various power plants and substations in such a way that uninterrupted electric service will be assured at all times. The Duquesne Light Co. now has 85,000 customers, 7 generating stations, 163 substations, 7375 miles of electric conductor and almost 1000 duct miles of underground conduit.

FAN SALES BREAKING RECORDS.

Reports from many parts of the country indicate that the present will probably be the best electric fan season in numerous cities. The continued hot weather has exhausted stocks at several points. In fact, the early onset of the hot spell in June caused unusually heavy sales for that month which are continuing. The records of 1916 are likely to be broken.

Central-Station Rates in Theory and Practice

Third Article—Capital Charges of Central Stations and How they Affect the Demand Cost—Interest and Depreciation—Influence of Peak Load on Expense

By H. E. EISENMENGER

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This is the third article of a series to appear weekly throughout the current volume. A general outline of the entire series was published in the issue of July 5 and the first of the articles appeared July 12. In the first two articles the author discussed costs in general and then took up the cost of electric service in particular, showing that the three principal elements of this cost are energy cost, demand cost and consumer cost. The present article continues the discussion of demand cost, which will necessarily be extended through several installments. The reader must realize that a knowledge of the various elements on which the cost of the service depends is necessary before the subject of rates (or price of the service) can be properly discussed.

PART I—THE COST OF ELECTRIC SERVICE—Continued.

II-A. The Three Elements of Cost.

A. THE TOTAL DEMAND COST OF THE PLANT.

2. The Constituents of the Demand Cost.

a. Capital Charges.

1. Net Return (Interest, Dividend).

SECTION 18. The capital invested in a commercial enterprise has been paid in by its owners because they have the belief that they will get a satisfactory return, whether that be a certain prearranged fixed percentage, as on bonds, or a variable one in accordance with the degree of success of the business. (See Insert III-A.)

This return on the capital is the *raison d'être* of any business enterprise and therefore it has been mentioned first. As a matter of fact it is the last one of the capital charges inasmuch as all the other charges to be mentioned hereinafter (depreciation, repayment, taxes, insurance, etc.) must be, or should be, considered first. We can thus distinguish a gross return and a net return, both of them being based on the *net* income. The gross return includes all capital charges, or at least depreciation and possibly repayment[1]; after deducting all those charges from the gross return we get the net return which is paid to the owners of the capital as bond interest and stock dividend.

We have therefore to distinguish the following four items:

1. Gross income.
2. Net income = gross income — cost.
3. Gross return = $\frac{\text{net income}}{\text{capital}}$, usually given in per cent.
4. Net return = percentage gross return — percentage depreciation, etc.

2. Depreciation.

19. For practically all construction work, whether it be machinery, or buildings, or electric lines, etc., we can figure that after a certain number of years it has to be replaced because it is worn out and useless. How great this number of years is depends largely on the nature of the construction. A building may last 50 years or longer, a pole of an overhead line may be too decayed for further use after 10 years or less, etc. The value will decrease year after year and this is called the depreciation of the construction.

Moreover, some parts of construction, especially machinery, must not infrequently be discarded long before they are physically unfit for further use because new inventions have been made and it has become either more economical or otherwise advisable to install machinery which embodies the new improvements rather than to continue employing the old obsolete machinery. This has, for instance, been frequently done in the last few years with reciprocating steam engines, which, although still in their prime of life and perfectly serviceable, had to be exchanged for the newly invented steam turbine because the latter consumes so much less steam (and requires so much less space) that the whole interest and other investment charges on the steam-turbine set would be less than the cost of the steam saved[2] annually. The reciprocating engines were kept as reserve capacity in case of breakdowns or they had to be sold at what one could get for them—that is, the so-called scrap value, which generally is only a small percentage of the price paid originally.

We see therefore that the value of the capital invested in an electric plant is not, without further measures, safe and secure for all times, but that on the contrary this value is incessantly and automatically being reduced and we must take steps to counterbalance this reduction of value by creating a fund into which the equivalent of the depreciation is deposited out of the annual earnings before we apply the latter for profit.

Suppose, for instance, we have bought a generator set for $100,000 and after 12 years it is worn out and has to be scrapped, the scrap value to be $10,000. The balance of $90,000 has disappeared out of the generator set and if we do not want to lose that amount we must have earned so much over and above the

[1] Taxes and insurance are frequently counted as cost, although from the present point of view they should rather be classified as capital charges.

[2] And capital charges on the floor space saved, which can be utilized for extensions of the capacity.

interest that the aggregate of these yearly excess earnings with compound interest has accrued after 12 years to make up the $90,000 which has disappeared. We have to establish a "depreciation fund" into which regular payments are made every year and invested at compound interest. That means, for instance, if we invest the money accumulating in the fund at 5% compound interest, we have to pay in every year about $5650 for depreciation, or 5.6% of the original capital of $100,000; then at the end of 12 years we will have $90,000 accumulated in the fund which, together with the expected proceeds of $10,000 from the sale of the scrapped generator set, will just about suffice to buy a new generator set in place of the old one.

Of course, all these calculations have to be rather crude ones as the figures we are dealing with are all known only very approximately. We do not know what the actual useful life of the generator will be. We can be guided from past experience, which is laid down in tables for various classes of machinery and other constructions, but these tables give, of course, only average values and, moreover, when it comes to obsolescence, due to future new inventions, we are entirely at sea. Even apart from obsolescence, we do not know how great the scrap value will be and what the price of the new generator set will be in about 12 years from now, etc. But something near that figure (5 or 6%) will have to be put aside every year for depreciation in the assumed simple case.

20. It is obvious that in this hypothetical simple example the money in the depreciation fund rises from zero at the beginning of the first year to 100% of the net replacement value at the end of the twelfth year and then drops suddenly to zero again as the new generator is bought. This 12-year cycle is periodically repeated an indefinite number of times. As the value disappears from the physical property by depreciation it turns up in the depreciation fund and then by purchase of a new equipment flows back into the physical property, thus fluctuating in a 12-year cycle to and fro between the two. In practice, however, the fluctuations of the fund are not as large but much smaller, for several reasons, which are briefly explained in Insert III-B.

3. Repayment (Sinking Fund).

21. Where, as usually, a portion of the company's capital has been raised by bonds, these bonds mature within a certain time, for instance, after 20 or 30 years; this means that the principal (face value of the bonds) has to be paid back at that time according to the terms of the loan. It is then most commonly raised by a new issue of bonds. An alternative is the creation of a fund for the payment of the bond indebtedness ("sinking fund"). A certain amount must be paid into this fund every year of such size that at the time when the bond issue matures the accumulations in the fund with compound interest aggregate to just the face value of the maturing bond issue.

In some cases the franchise granted to the company stipulates that the franchise will expire after several decades, perhaps after 30 or 50 years, and that the equipment of the company has to pass at that time into the hands of the city, or some such body, without any compensation whatever to the company. If we want to be very exact and careful, we will have to create another sinking fund in such cases of such size that this fund, together with the liquid amount contained in the depreciation fund at the end of those 30 or 50 years (or whatever the term is), amounts to just the capital invested. The depreciation fund and the sinking fund together will then, at the time of the termination of the franchise, serve to pay back the face value of all stocks and bonds. Now, it is obvious that under these conditions any company will endeavor to avoid replacements of machinery, etc., during the last years of its franchise, as it knows that in the near future it will have to give up, without any compensation, its physical property. Consequently, at the end of the period the depreciation fund will be as nearly 100% filled as it can be. The plant will be run down and an unusually large portion of its value will have passed over into the depreciation fund. For this reason and because, in view of the great length of time, the annual payments into a repayment fund of that kind would be a very small percentage, these payments are sometimes neglected.

4. Other Capital Charges.

22. Interest, depreciation and possibly repayment are not the only annual capital or investment charges. *Taxes* are mostly in accordance with the value of the property—that is, in first approximation, with the capital invested. The cost of *insurance* also is the higher, the costlier the plant. These two items may therefore in first approximation be regarded as proportional to the capital invested.

23. We come to the conclusion that we can, as an approximation, assume every one of the capital charges, whether interest, depreciation, repayment or other charges, as proportional to the capital invested and therefore we can also assume the sum of these items, that is, the total capital charges, to be approximately proportional to the capital invested. The capital charges are therefore proportional to the plant capacity and in further approximation to the plant's peak load.

b. Demand Cost Other Than Capital Charges.

24. In addition to the above expenses we have certain other expenses which are not capital charges but which also depend on the size of the plant only, and may be assumed to be proportional to the latter and consequently to the peak load.

Thus, a certain portion of the fuel and lubricating cost and of the cost of maintenance and repairs, etc., may depend on the size of the plant. To explain this, let us assume, for instance, that we have to generate 24,000 kw-hr. in 24 hours by a 1000-kw. generator set, running at full load. Let us assume further that we have in another instance to generate the same number of 24,000 kw-hr. in the same total time of 24 hours, but no longer at uniform load, but with a 4-hour uniform peak period of 5000 kw. This would, of course, require an equipment of larger capacity, for instance, a 5000-kw. set instead of the 1000-kw. set. During these four peak hours the generator would furnish $4 \times 5000 = 20{,}000$ kw-hr., leaving 4000 to be generated during the remainder of the day —that is, during 20 hours. The average load during these 20 hours will therefore be only 200 kw.—that is, 4% of the capacity of the 5000-kw. generator.

Now, large generating units are more efficient than small ones; that means they are consuming fuel more economically per kilowatt-hour output than small ones running at the same percentage of their normal (full) load. The same refers to consumption of lubricants. On the other hand, there is a certain economic load for every generator set at which the latter is most efficient; this load is near the rated or normal load of

the set. As the load decreases below that amount the specific fuel and oil consumption *per kilowatt-hour* is getting larger and larger, and for small percentages of full load it will become quite high.

In the assumed example the 5000-kw. generator will therefore work more efficiently than the small one during the four hours of its full load, generating in that time 20,000 kw-hr. During the remaining 20-hour period the large generator will work less efficiently than during the peak load period and, in fact, it will work quite wastefully, as it is running at only 4% of its normal load. The average efficiency at which the large generator supplies the energy is therefore in general different from the efficiency of the 1000-kw. set. It may be higher or lower, depending on the way in which the efficiency varies with the size of the generator and with the percentage of the load. In practice, these figures are such that an increase of the demand will under the given conditions probably always result in a decrease of the average 24-hour efficiency and therefore in an increase of the fuel and oil consumption.[3] We see from this how the peak load of the central station influences the cost of fuel and lubricants in such a manner that under the given assumptions a part of these costs may be assumed to be proportional to the peak load.

Similar considerations prevail for the maintenance and the repairs of the equipment. As regards the total cost of attendance, it will of course always be larger for a larger machine than for a smaller one, etc.

25. We see in this manner that there are certain costs which are not investment charges, but still are dependent on the peak load and can be assumed to be proportional to the peak load. Together with the capital charges which are, as shown, also approximately proportional to the peak load they make up the *"demand cost,"* sometimes called *"fixed cost."* The demand cost of a central-station plant can therefore be assumed as being proportional to the central station's peak load. This involves, as we have seen, certain approximating assumptions which are recapitulated and discussed more in detail in Insert V.

Insert III—Appendix to Sections 18 and 20.

Interest and Depreciation.

A. Interest on the Capital Invested.

(To Section 18.)

The capital invested in fairly sized electric central stations is practically never the property of an individual, but belongs almost always to a corporation and we have to distinguish various ways in which this capital or its parts have been raised, as this influences the distribution of the interest.

A (physical or juristic) person desiring to invest money in an enterprise of that kind may do so either by becoming part owner of the company's property or by lending money to the owners at a certain prearranged rate of interest without acquiring any rights or duties of ownership in the latter case. The company's property serves as security for the loan. In the first case the person investing money receives *shares of stock*, which are certificates that he shares in the ownership, and in the second case he receives *bonds* (or notes), which are receipts for money and a promise to pay together with interest at a rate agreed upon. When a person buys stock he becomes in a sense a partner of the enterprise and if he buys bonds or notes he becomes a creditor and as a creditor has no proprietary interest.

The capital may be raised entirely by bonds (municipal enterprises), or entirely by stocks, or (usually) partly by stock and partly by bonds. The revenue of the enterprise is used to defray the running expenses (wages, salaries, raw material, etc.), after this the fixed amount of interest on bonds and the other capital charges, like depreciation funds, sinking funds, etc., (see Sections 19-22) are taken care of. The stockholders are entitled to the entire balance, which may be large or small or zero, according to the prosperity of the enterprise.

The stock may be all *common stock* or a part of the capital may have been raised by the issuance of *preferred stock*. The difference between common stock and preferred stock is the same as that between stocks and bonds, as far as the payment of interest is concerned. The holders of the preferred stock receive a certain prearranged rate of interest from the balance of the earnings after the bond interest has been deducted and, unless the preferred stockholders can receive their full rate of interest, the holders of the common stock will not be paid any return on their investment. Sometimes the preferred stock is subdivided into first and second preferred, so that the interest on the second preferred is paid out of the balance remaining after the deduction of the interest on the first preferred.

The preferred stock may be "participating" or "non-participating." In the first case, after the preferred stock has received the dividend provided for, and after the common stock has received a certain prescribed dividend, the balance of the profit is divided between the preferred and the common stock. In the second case, which is the usual one, the whole balance goes to the common stock.

The dividend on the preferred may be "cumulative" or "non-cumulative." This means if the enterprise has not had earnings enough to pay the full percentage on the preferred stock in one year the holders of cumulative preferred stock will be indemnified at the expense of the common stock dividend as soon as the earnings become better in subsequent years, whereas with non-cumulative preferred the holders have no claim for indemnification out of the earnings of later years.

B. A Few General Remarks About Depreciation Funds.

(To Section 20.)

The reasons why the depreciation fund does not, as may seem from the simple example of Sections 19 and 20 of the main text, fluctuate between 0% and 100% of the net replacement cost but within much narrower limits are briefly the following:

In the first place, the plant contains different parts with different lengths of life so that the fluctuations of the respective parts of the depreciation fund overlap each other.

In the second place, the growth of the plant in the course of the years must be considered; in other words, the fact must not be lost sight of that the entire existing plant has not been built at the same time, but at different periods. This causes another overlapping and consequent smoothing out of the fluctuations of the various parts of the depreciation fund[1].

In the third place, where we have a greater number of parts of the plant, even if all have the same average life and all have been installed at the same time, they will not all have to be replaced in the same year, because the actual life of the individual part is generally not equal to the average life. If, for instance, we have installed in a certain year a new transmission line with wooden poles having an average life of 10 years, though we will have to replace a large number at the end of the 10th year and in the years near it (for instance, between the ends of the 6th and 14th years), yet when the transmission line is old enough so that every pole has been exchanged several times, the varying periods of life of the individual poles evidently will overlap finally to such a degree that we have to exchange the same number of poles every year, namely, 10% of the total number.

That the depreciation fund is far from reaching 100%, even at the time when the first replacement is due, is shown by Table 1, which is based on the arbitrary but verisimilar assumption that the number of poles which require their first replacement in each year is as given by Column II of the table. (The interest accruements to the fund and the consequent reduction of the annual payments are disregarded in this table as non-essential for the present purpose.)

[3] We would, of course, for the very reason of improving the economy of generation not install (as assumed) one unit of 5000-kw. in the above example, if we could choose the size and the number of the generating units in such a manner that a better 24-hour efficiency can be obtained. It is then conceivable that the change of the load curve (that is, the increase of the peak load) may bring about a reduction of the fuel and oil cost, that is, that the percentage of the fuel and lubricant expenses (which is proportional to the peak load) is negative. The explanation of this apparent contradiction with what has been found above is given in Insert IV—"The Influence of the Central Station's Capacity (Peak Load) on the Operating Expenses."

[1] Very interesting investigations on the subject of depreciation in connection with the growth of the plant are published under the title "Growth and Depreciation," by Julian Loebenstein in the 1916 Transactions of the A. I. E. E., pages 1389 to 1407.

TABLE 1.

I. End of Year.	II. Percentage Poles Requiring First Replacement in Respective Year.	III. Aggregate Percentage of Poles Requiring First Replacement up to Respective Year.	IV. Percentage Payment Into Fund in Respective Year.	V. Aggregate Percentage Paid Into Fund.	VI. Balance Remaining in Fund. (Column V — Column III.)
1	..	..	10	10	10
2	..	..	10	20	20
3	..	..	10	30	30
4	..	..	10	40	40
5	..	..	10	50	50
6	3	3	10	60	57
7	5	8	10	70	62
8	12	20	10	80	60
9	15	35	10	90	55
10	30	65	10	100	35
11	15	80	10	110	30
12	12	92	10	120	28
13	5	97	10	130	33
14	3	100	10	140	40
15	..	100	10	150	50

Note.—Commencing at the end of the 12th year the second replacements begin for which corresponding amounts are taken out of the fund. As the second replacements are not considered in this table, the values of Column VI beginning with the 12th year are slightly too high.

The maximum amount ever contained in the replacement fund is then 62% of the net replacement value and this maximum occurs in the 7th year. As shown above, the replacement fund is generally reduced in the course of the following renewal periods to the limit of 10%, so that 52% are set free.

It is very interesting to observe that the transition from the 62% to the 10% is not a steady reduction but is made up of oscillating increases and decreases. Column VI of the above table shows this tendency very clearly. The oscillating character of the decrease is still better brought out by the following considerations: Assuming, for instance, the first renewal ("renewal of the first order") to be spread out over four years from the ends of the 8th to the 12th years, inclusive, the first poles will have to be replaced at the end of the 8th year while others will last as long as 12 years. Now, some of the most short-lived poles (8-year poles) will be replaced by equally short-lived ones. This may be an accidental coincidence or the local conditions may be so unfavorable that in that location the renewed poles will generally require replacement after every 8 years; at any rate, the period of the second replacement of poles will begin at the end of the 16th year. On the other hand, some of the most long-lived poles (12-year poles) will last another 12 years after replacement before a third pole has to be installed in that locality. Thus the second replacement period is spread out between the ends of the 16th and the 24th years—that is, over 8 years as against 4 years of the first replacement period. Following the same line of thought further, we get the data of Table 2.

TABLE 2.

Replacement.	After	Years Duration.
1st	8th to 12th year	4
2nd	16th to 24th year	8
3rd	24th to 36th year	12
4th	32nd to 48th year	16
5th	40th to 60th year	20

Since in every renewal period the same total number of poles has to be replaced, namely 100%, and as the renewal period spreads out over greater and greater lengths of time, it is obvious that, as the renewals progress, less and less poles are to be renewed in every year as far as one certain order of renewals (first, second, third, etc.) is concerned. On the other hand, the renewals of different orders overlap more and more. For instance, in the 34th year we have a number of poles to be renewed for the third time and others for the fourth time (see third and fourth lines of Table 2). These conditions are shown in Fig. A. The lower part shows how around each renewal period (10th, 20th, 30th, etc., year) renewals have to be made and how the lengths of the renewal periods spread out from one period to the next, whereas the number of renewals of the same order to be made during one certain year decreases as time goes on. The upper part of Fig. A then shows the sum of the renewals of all orders in every year and demonstrates clearly the fluctuations with decreasing amplitude (damped oscillations), converging to the 10% limit[2].

The interesting subject of depreciation is sufficient for a treatise in itself, but the above remarks are all that is considered necessary for the scope of this series of articles.

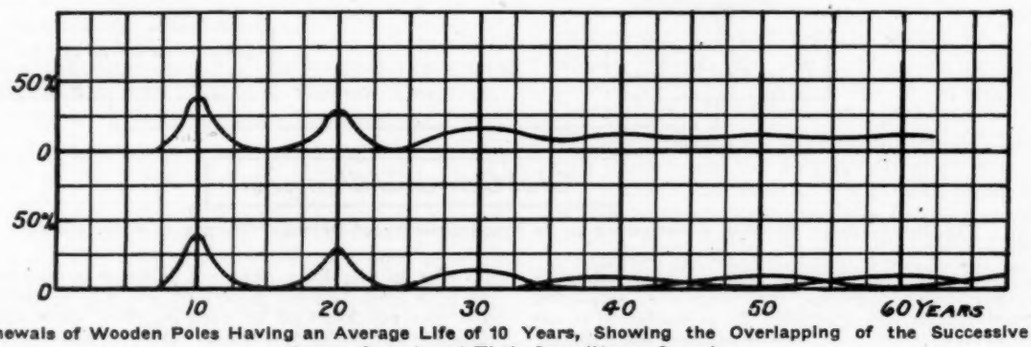


Fig. A.—Renewals of Wooden Poles Having an Average Life of 10 Years, Showing the Overlapping of the Successive Renewals (Lower Curve) and Their Sum (Upper Curve).

Insert IV—Appendix to Footnote of Section 24.

THE INFLUENCE OF THE CENTRAL-STATION'S CAPACITY (PEAK LOAD) ON THE OPERATING EXPENSES.

The example of Section 24 deals with a four-hour load of 5000 kw. and a 20-hour load of 200 kw. every day, and it is assumed that to carry this load a 5000-kw. generator would be installed.

We will, of course, try to improve on this and choose the size and the number of the generators in such a manner that a better 24-hour efficiency results. Other factors beside the efficiency curves also take a part in this problem; for instance, the reserve capacity, changes of load to be expected in future, the prices of generators of different sizes, the value attached to efficiency of generation as compared to savings in the capital invested, etc. The price of the fuel, oil, etc., will in its turn influence the relative value attached to the efficiency of generation and we might continue this analysis of influencing factors until we arrive at the mood in which the designer of the plant found himself when he made this decision about the size of the sets and whether at that time he happened to take a more or less optimistic view of the future growth of the plant, etc.

Assuming that we could be fairly positive about the constancy of the load curve in the future, special investigations might show that it is advisable to install two units of 5000 kw. (one of them as reserve) and one of 200 kw., or possibly three 2500-kw. sets, or some such combination. Now comparing, for instance, the first one of these two combinations ($2 \times 5000 + 200$ kw.) with the 1000-kw. set for uniform 24-hour service (see Section 24) it is evident that the efficiency will probably be greater than at uniform 24-hour service, because the bulk of the energy (20,000 kw-hr. or more than 83%) is generated by an economical 5000-kw. generator at full load—that is, by a generator five times greater than in case of the uniform 24-hour service, whereas less than 17% is generated by a (fully loaded) generator only one-fifth as large (200 kw.) as in case of the uniform 24-hour service. This means that the demand will have a *negative* influence on the fuel and oil consumption; in other words, the larger demand will result in a *reduction* of the fuel and oil cost. (The same will probably be true for the 3×2500-kw. combination.)

This seems peculiar. In the first instance [using 5000-kw.

[2] M. D. Cooper, of the National Lamp Works, has made interesting investigations on a closely allied field, the replacement of burnt-out incandescent lamps (Electrical World, Jan. 12, 1918, pages 93 to 95) in which he shows that the number of renewals of lamps installed at the same time and always burning simultaneously is subject to periodic fluctuations until, after a number of lamps have burned out in each socket, the stable condition is reached.

units throughout (Section 24)] we saw that an increase of the peak load from 1000 to 5000 kw. resulted in an *increase* of the fuel, etc., cost and now the same change of the peak load results in a *decrease* of these costs. The explanation is that a certain portion of the fuel, etc., cost is neither proportional to the demand nor to the energy consumption, but depends on some other elements which are not among the three fundamental items considered in our system of cost computation (compare Section 10). A portion of the fuel consumption depends, for instance, on the shape of the load curve, another portion on the size of the machines, etc. We try to apportion this part of the fuel cost somehow into the vary to a large degree in the course of years, this will simply mean that the factor of proportionality—that is, the annual capital charges per kilowatt of peak load—will have to be changed.

Supposing, for instance, that in a certain territory the use of electric service is not very widely spread; then the copper section of the lines is not fully loaded (because the lines must have a certain minimum of copper section for mechanical reasons). If now the use of electric service becomes more general in that town the wires will first become fully loaded and then we will have to string additional wires, but the existing poles can be used for the new wires, so that

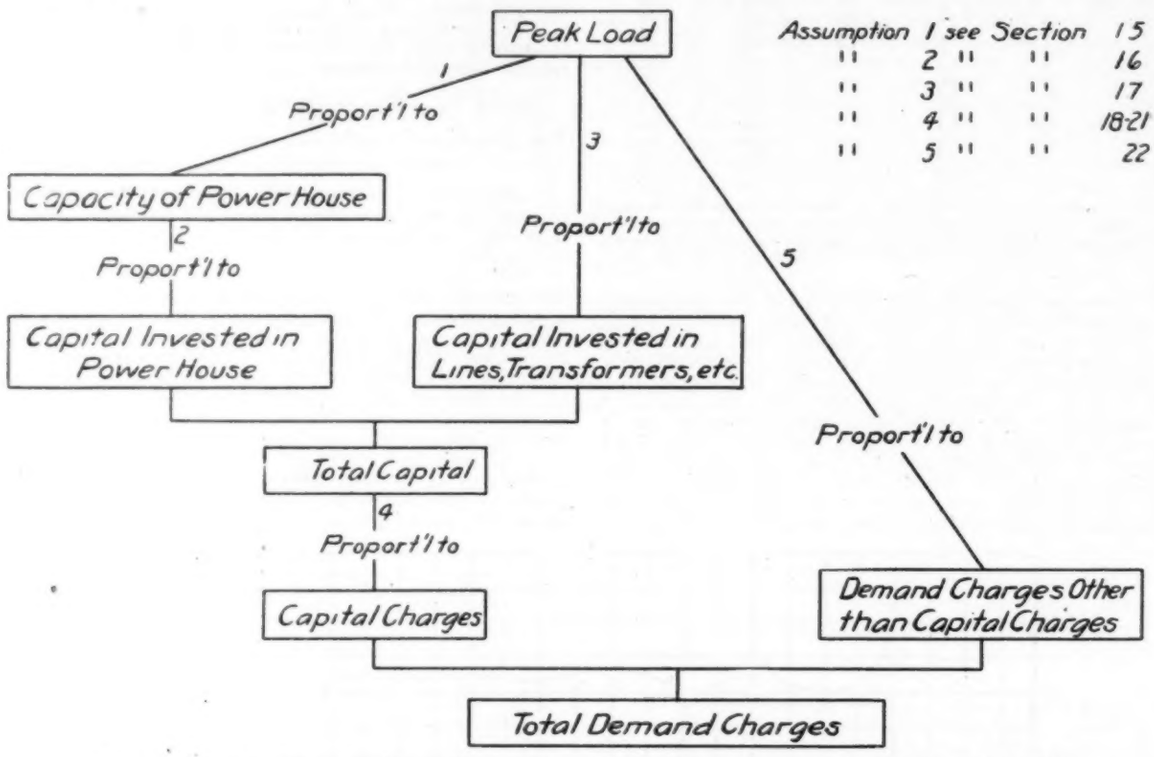


Fig. B.—Diagram Showing Assumptions as to Proportionality of Demand Charges to Peak Load.

three items, just as we squeeze in the salaries of the executive officers, the advertising expenses, etc., somewhat sacrificing accuracy for simplicity and practicability, as explained in the general discussion of costs. The result of these little inaccuracies, which are entirely permissible, are little inconsistencies as the one just quoted above—the relation of the demand and the cost of fuel. To be exact we would have to say: Under the given conditions with regard to changes of the load curve, size of machinery, etc., a certain given portion of the fuel, etc., costs is proportional to the maximum demand and the factor of proportionality has a certain given—positive or negative—value. More particulars about this question will be given in Insert VIII about the determination of the numerical values of the three items of cost.

Insert V—Appendix to Section 25.

Approximations Made to Compute the Demand Cost of the Plant.

The approximating assumptions which permit us to set the demand cost of an electric plant as proportional to the peak load of the plant (see Section 25 and footnote 2 of Section 17) are shown in comprehensive form in the diagram of Fig. B. These approximations bring about much less inaccuracy than would seem at first sight, because we have to deal always with the changes produced in one *individual* central station only by the changes of its peak load and these latter changes remain within certain limits during a given period..

Thus, for instance, if the peak load of the central station increases from 5000 to 6000 kw. in one year, the other conditions, such as the geographic distribution of the load over the territory of supply (approximation 3), or the percentage of reserve capacity, etc. (approximation 1) will not have to be changed very materially. If, however, these conditions do the cost of the lines does not increase proportionally with the peak load. Larger generator sets will be installed, which cost less per kilowatt of capacity than those originally installed. For these and many other reasons the capital, and consequently the total annual capital charges, will under these conditions grow more slowly than the peak load does. Yet we assume that they grow at the same rate, for a number of years at least—that is, that they remain proportional to the capital. If the discrepancy in the course of the years becomes too great we simply change the factor of proportion-

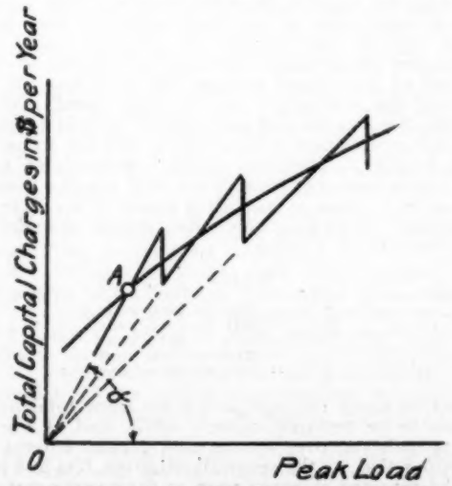


Fig. C.—Relation of Capital Charges to Peak Load.

ality—that is, we change the number of dollars per kilowatt per year to another one for the following period.

Readers who are familiar with the elements of graphic representation may get further illumination on this point from Fig. C. (An example of the principles of graphic representation employed therein will be contained in Insert XII on Step Meter Rates.) The central station's peak load is stepped off on the axis of abscissae (horizontal) and the ordinates give the corresponding total yearly capital charges per year, in dollars per year. If we connect a certain point *A* of that curve with the origin *O* of co-ordinates, the angle α between this connecting line and the axis of abscissae will be the greater the greater the capital charges per kilowatt of central-station peak load ("unit capital charges") are. (Readers who are familiar with elementary mathematics will understand that the unit capital charges are given by tan α.) Assuming the unit capital charges as being constant means that we replace the curve of the actual unit capital charges by a straight line starting from the origin with an inclination depending on the size of the assumed constant unit capital charge. If this angle of inclination is chosen properly—that is, if the value for the constant unit capital charge is chosen properly—the straight line will more or less closely follow the curve, at least for a certain distance, because the curve must necessarily rise from left to right. Where the deviation of the straight line from the curve becomes too great we substitute another straight line. This means that when the peak load in the course of the growth of the central station becomes so great that the constant unit capital charge used so far becomes too inaccurate, we revise the calculation of the unit capital charge and substitute a corrected value.

In normal times this revision will always be a revision downwards, owing to the smaller unit capital which is necessary for a large plant. But in times of war, or when money is very scarce, etc., it is conceivable that in spite of the growth of the plant, the unit capital charges may rise.

(To be continued.)

TELEGRAPH SYSTEMS IN THE UNITED STATES.

Census Bureau's Report for 1917 and the Five-Year Period 1912-1917—Commercial Wire and Wireless Telegraph Systems—Telephone Train Dispatching.

According to a report just issued by Director Sam L. Rogers, of the Bureau of the Census, Department of Commerce, the 21 commercial land telegraph systems in the United States in 1917 operated 241,012 miles of pole line, comprising 1,888,793 miles of wire; sent 151,725,238 messages; and employed 47,227 persons, to whom were paid salaries and wages amounting to $36,392,140. This report, which is issued under the title "Telegraph and Municipal Electric Fire-Alarm and Police-Patrol Signaling Systems," was prepared under the supervision of Eugene F. Hartley, chief statistician for manufactures, and is the fourth of a series of quinquennial reports on the telegraph systems of the country.

The pole-line mileage in 1917 was less by 2.6% than in 1912, but was greater by 0.6% than in 1907. The wire mileage, however, showed an increase of 4.1% as compared with 1912 and of 19.7% over 1907. The increase in the number of messages was much greater—45.7% during the last five-year period and 53.1% during the ten years from 1907 to 1917. The number of employes increased by 39.2% between 1912 and 1917 and by 84.9% during the period 1907-17, and the corresponding percentages of increase in their salaries and wages were 59.2 and 124.2.

The number of telegraph offices in 1917 was 28,865, a decrease of 6.2% as compared with 1912 and of 0.7% as compared with 1907. The total income from telegraph traffic was $91,312,567, an increase of 74.5% over 1912 and of 140.8% as compared with 1907; the income from all other sources was $1,641,803; the total expenses, including charges for depreciation and sinking funds, were $80,828,970, an increase of 52.9% over 1912 and of 111.4% over 1907; and the net income was $12,125,400, an increase of 253.4% as compared with 1912 and of 113.7% over 1907. The par value of the outstanding capital stock of the companies was $106,360,237, a decrease of 1.7% as compared with 1912, but an increase of 4% over 1907.

The foregoing figures relate only to commercial telegraph companies, and thus exclude the wire and pole line wholly owned and operated by railroads, and also exclude the equipment and telegraph business of the various press associations which lease and operate wires for dispensing news.

The Postal Telegraph-Cable Company transacts some little telephone business in addition to its telegraph business. Its development of long-distance telephone service has been particularly rapid in the South and Southwest.

During the five-year period 1912-1917, the printing telegraph came into extended use by telegraph companies, press associations, and railroads. The printing telegraph consists essentially of a sending instrument, equipped with a keyboard similar to that of a typewriter, electrically connected with a receiving instrument in such a manner that the latter automatically reproduces what is typewritten on the sending instrument. Without the printing telegraph it would have been difficult or impossible to handle the increased telegraph business during the World War.

A special feature of the report, relating to train dispatching, is of some interest. The first installation of telephone and selector equipment for train dispatching was completed on the lines of the New York Central Railroad in October, 1907. The use of the telephone for this purpose has increased rapidly. The report shows, for 1917, 105 lines employing this method of train dispatching, as against 42 in 1912. The mileage of telephone pole line for train-dispatching purposes was 95,268, an increase of 67.6% as compared with 1912; and the mileage of wire was 201,662, an increase of 55.7% over 1912. The total line mileage of railroads reporting the use of telephones for transmitting train orders in 1917 amounted to 110,404. It is asserted that not a single accident has resulted from the use of telephones in train dispatching.

All the wireless telegraph systems in the United States were taken over by the Federal Government under authority of an executive order issued April 6, 1917, for which reason the figures for 1917 give little indication of the increase in commercial wireless telegraph operations during recent years. The systems reported for 1917 numbered 3, as compared with 4 in 1912 and 5 in 1907; and the number of tower stations was 63, as compared with 74 in 1912 and 117 in 1907. The number of messages handled prior to April 6 was 122,244. No exact record of the number transmitted during the period of Government operation is available, but it is roughly estimated that 330,000 messages were handled between April 6 and Dec. 31, 1917. This number, added to that already given, would make a total of more than 450,000.

The total income and the net income increased greatly. The former aggregated $1,385,060 in 1917, representing a gain of 107% over 1912 and of 1197% over 1907; and the latter amounted to $609,526, as compared with a net income of $4738 in 1912 and a net deficit of $53,538 in 1907. The employes numbered 586, a decrease of 38.8% from the corresponding number in 1912, but an increase of 233% over the number for 1907; and their salaries and wages aggregated $461,402, an increase of 17.2% over 1912 and of 464.2% over 1907.

Contractor-Dealers Hold Enthusiastic Annual Convention

Proceedings of 19th Annual Convention of National Association of Electrical Contractors and Dealers Held in Milwaukee—Merchandising Principal Topic — Repair and Labor Problems also Discussed

BETTER MERCHANDISING with a view of increasing the use of electric apparatus and improving conditions in the electrical contractor-dealer field was the principal topic of discussion at the recent annual convention of the National Association of Electrical Contractors and Dealers held in Milwaukee, July 16, 17 and 18, although many other topics of interest were also presented and fully discussed. The remarkable growth of the retail electrical store idea during the past two years, largely through the efforts of W. L. Goodwin and his associates, is largely responsible for the enthusiasm and keen interest displayed in this subject and it is evident that the advancement in this direction will continue, that more and better retail electrical stores will be established and all will be conducted in accordance with the best and latest merchandising practices. This was also the subject of many interesting addresses by prominent speakers, who described and explained not only the fundamentals of merchandising but the proper conduct of a retail store and offered many valuable suggestions to merchants and prospective merchants.

The proper relationship between employer and employe that will make it possible for both to live and work together in harmony and progressive efficiency, was another principal topic and one that in its discussion, better than any other, demonstrated the progress that has been made by the association and its members. This subject, which finally resulted in the adoption of the "Declaration of Principles" published further on in this report, was discussed freely and with considerable spirit at the meetings of the Executive Committee and on the floor of the convention on Friday afternoon. In addition, a very interesting and instructive address on this subject was delivered by H. C. Metcalf, Ph. D., Bureau of Industrial Research, New York City. In the discussion the membership showed that it has advanced far beyond its former standing and is ready and able not only to take its place in the world of business but to be the leaders in that sphere.

The meeting of the Repair and Sale of Used Apparatus Section also proved of great interest to those members engaged in that line. This meeting was the first of its kind ever held by the association, but, from the results obtained and the interest displayed by those who attended this meeting, there is no doubt but that they will be a regular part of future convention programs.

Throughout the entire convention the more than 400 members who registered exhibited the keenest interest in the proceedings and in the discussions and by constructive criticism and suggestions did much to make this the best convention the association ever held. And, they evidently succeeded for the consensus of opinion among the older members seemed to be that this was really the best convention ever held and that it would rank high among all electrical conventions.

Meetings on Opening Day

A complete report of the sessions on the opening day, Wednesday, was published in our July 19 issue. At the morning session on this day the delegates were welcomed to Milwaukee by Cornelius Corcoran, acting mayor of the city, to which W. Creighton Peet, chairman of the association responded. In his address Chairman Peet briefly reviewed the activities of the association during the past year and described the work now under way. Through co-operation with the other branches of the industry the Bureau of Education and Research is now fully developed and is expected to begin its labors in the field shortly. Other committees have also been very active, particularly since the armistice was signed, which has resulted in a large amount of work for the good of the association and its members being accomplished.

Franz Nielsen, counsel for the association, then spoke on "Co-operation in Business." He described the growth of the co-operation idea and the many advantages which it offers to the contractor-dealer in his relation with other merchants and the other branches of the electrical industry. He spoke of the work that the association has done to further this idea and the remarkable results that have been obtained, as evidenced by the conference held on Monday evening to complete the arrangements for the educational campaign. In closing he urged the members to take a more active part in the work of the association and to assist its officers, willingly, in every possible way.

In the afternoon Frank Stockdale, of Chicago, delivered a very interesting address on "Keeping Up With Rising Costs." In this address, Mr. Stockdale carefully analyzed merchandising, particularly as applying to the electrical retailer. Many valuable suggestions for the retail merchant in the conduct of his store were brought out and many of his problems were explained. He particularly emphasized the need for keeping a proper cost accounting system in order that the dealer may keep a check on his business. The cost accounting system that has been developed by the association, he stated, was one of the best and simplest he had ever seen and recommended its adoption by all of the members.

Albert Uhl and E. L. Morley, representatives of the Chicago Electrical Estimators' Association, then explained the work that has been done and is being done by that association. Mr. Uhl described the estimating forms that have been developed and which offer many advantages in making and tabulating estimates for electric wiring. Several minor changes have recently been made in these forms which render them much more convenient than they formerly were. The forms were illustrated by lantern slides which added greatly to the effectiveness of the address and brought out their many advantages very clearly. Mr. Morley described the work that the association has done in solving the problems of overhead on construc-

tion work which has already received a great deal of attention among electrical contractors. These lectures brought out considerable discussion which clearly indicated the interest which the members take in such work and the value of the results obtained by the Estimators' association.

In the evening a reception and dance was held at the Hotel Pfister which was very well attended and proved to be a very enjoyable occasion.

"Goodwin" Day at Waukesha Beach.

The session on Thursday, which was styled a "Goodwin" day as a mark of appreciation to W. L. Goodwin of the General Electric Co., and his untiring efforts in behalf of the association, was held at Waukesha Beach, a beautiful resort located about 25 miles from Milwaukee, and an especially fitting place for such an affair.

The opening address on this occasion was delivered by J. H. Moss, former president of the Milwaukee Association of Commerce, on "Americanization." In this address, Mr. Moss emphasized the importance of naturalizing the foreign element in this country and the dangers of neglecting to do so. Materially, it is estimated that a saving of two billion dollars annually, will result from such naturalization as the education thus acquired will greatly increase the earning power of these inhabitants. As their education could be accomplished for only a small part of this sum it is surely worth the effort. Politically and morally the results would also be highly desirable, particularly at this time when the country faces a crisis in many ways and as the number of illiterate foreign born is steadily increasing. In Mr. Moss' opinion there are two phases to this problem, immigration and education, which must be studied and suitable remedies applied if the proper solution is to be arrived at.

In introducing W. L. Goodwin, who was the next speaker, Chairman Peet took occasion to thank both Mr. Goodwin and Samuel A. Chase of the Westinghouse Electric & Manufacturing Co., for their unselfish efforts in the work of the association.

At the opening of his address on the fundamentals of merchandising, Mr. Goodwin heartily endorsed the new educational campaign that has been developed by the association and which will be put into effect shortly. The conference held on Monday evening to complete the arrangements for this campaign and which was attended by representatives of every branch of the industry, proved conclusively he stated, that this campaign has been the means of planting the germ of co-operation in the electrical industry. He also described the vast improvement that has been made by the contractor-dealer in his business affairs during the past two years and which he especially noticed in his recent trip around the country, particularly in regard to the improved credit and moral standing of these firms. In this way the contractor-dealers have already proven their ability.

There is still a lack of knowledge of merchandising, however, in spite of the fact that 350 retail electrical stores have been opened during the past two years with but one failure. In this way the electrical men have set a pace in merchandising and are fast regaining the business and although they do not wish to drive others out of this field they do desire to establish certain practices which if possible, will preserve the electrical business to the electrical people.

Merchandising is simple if properly understood and the need of natural ability to become a successful merchant is only true to a certain extent. The greatest need at the present time is for good stores and the next is to improve the packing of merchandise so that commodities may be standardized and a well ordered stock maintained. To accomplish this several manufacturers have changed their methods of packing their products, and very desirable results have already been obtained.

Delegates at 19th Annual Convention of National Association of Electrical Contractors and Dealers Assembled on Auditorium Steps in Milwaukee, Wis.

The location and the selection of goods salable in that community are very important items in the establishment of a retail store. There is always one class of merchandise that satisfies the local demand in any community and the dealer should handle that class rather than any other, even if the discount on it is not as great as in the others. For there is no profit until the goods are sold and larger discounts do not always mean larger profits. Nor should the dealer attempt to handle every concievable line but should concentrate on one line that he is sure will meet the rerequirements of his trade. Store employes with a knowledge of electricity and electrical apparatus are also necessary if the best results are to be obtained and the dealer should keep posted on his business by reading carefully the electrical trade papers. In this respect Mr. Goodwin advised every dealer to read a trade paper at least 15 minutes every morning if he is to keep abreast with the times.

There is also a tendency on the part of many electrical dealers to argue with their customers, which should always be avoided. No sale can really be con-

sidered completed until the customer is satisfied which shows particularly the value of only handling goods of known merit as the customer will usually accept goods on the dealer's recommendation. Another feature that must be appreciated is the value of attractive window displays. The most desirable store is of no value without a window and likewise the best window is worthless unless it is well decorated and attractive. Proper window displays he considers are of much more value to the dealer than larger discounts from the manufacturers.

The most important item retarding the growth of such stores is the lack of standardization of receptacles and wall outlets for the use of appliances. Due to the petty jealousies of the various manufacturers of such apparatus, practically every line requires a different type of outlet and receptacle which means that the customer must have several cords for the appliances in use. This of course retards the use of such appliances. The contractor-dealers, however, can force the manufacturers to standardize such connections, just as the lamp bases have been standardized and should take steps as soon as possible to bring this about.

Mr. Goodwin also urged the contractor-dealers to establish card records of prospective customers such as are used in many other industries, particularly by the piano and other musical instrument houses and mail order firms. These records could also be exchanged among the various dealers in the town and the central-station companies to advantage.

In order to assist the contractor-dealers in every way in the operation of retail stores and to encourage the opening of such establishments a lecture has been made up by the General Electric Co., in co-operation with the Westinghouse Electric & Manufacturing Co., which was given by J. A. Corcoran of the former company. In introducing Mr. Corcoran, Mr. Goodwin invited the criticism of those present, for it is only by such criticism that the dealers can secure the fullest results.

Mr. Corcoran's lecture was very interesting, bringing out many valuable suggestions for the proper conducting of a retail store which were illustrated with many charts and other properties that added a great deal to its effectiveness. Throughout the whole lecture there runs a strain of humor which serves to bring the suggestions out even more forcibly.

Sales, he explained, are the most important part of retailing and it is therefore very desirable for the dealer to know the extent of the possible field for electrical merchandise. There are at present 15,189,000 homes in this country not wired for electric service, while 5,500,000 are wired and the amount already spent in wiring houses is $275,000,000 against $759,459,000 which must be spent to wire the remainder. To accomplish this wiring of existing homes he estimates would take 10,000 contractors of average size, 20 years. The average percentage of income that the families of this country spent for electric current is 1/10 of 1%.

In order to secure the proper proportion of the business of the country the electrical dealer must first consider his points of contact with the public. There are five principal contact points,—store exterior, store interior, window display, publications and advertising. Next, he should appreciate the motives which prompt a purchase or buying motives of which there are also five —gain, necessity, pride, foresight and luxury. Every purchase is prompted by one of these motives alone or a combination of them. Memory is another feature that should be cultivated by the dealer both for himself and his customers, and this depends on association, repetition or intensity. He should also know the fundamentals of advertising,—interest, desire, action and in this he should remember that the nerves leading from the human eye to the brain are four times as great as those from the ear.

In choosing the location for a store the dealer should study the situation carefully and endeavor to locate along the principal trade stream. Such trade streams will usually be found near the local post-office, a large department store or the local central-station company's office and follow along the street in certain directions. However, it often happens that one side of a street affords a much better location than the other or the trade stream may stop at a certain point and turn back leaving the store but a few feet further on out of its influence.

The exterior of the store should be made as attractive as possible. This applies not only to the windows, sidewalks and doorway, but the upper floors as well, for the prospective customer sees the outside of the store first which also includes these upper floors, and their windows. The sidewalk in front should be free from any obstructions, such as trap-doors, etc., and the entrance should always be at the street level.

The most important factor of the store interior is the employes. The salespeople should know something about electricity and electrical apparatus and the stock in the store and the dealer's policies must be thoroughly understood. In the arrangement of the interior two plans may be followed, the jewelry and the hardware store styles. The former, which consists of a row of cases or shelves along the walls and a glass U-shaped counter in the center is preferable in some places but the latter with the sales counters along the side walls backed up by sheives is more generally used. In the selection of colors for interior displays and decorations considerable care should be taken. Nearly every color has some advantage which renders it especially fitting for certain displays, for example: red for intensity, blue suggests coolness, and grey is good for quality goods. Lavender, however, is only good for funerals and should always be avoided. Every sale should be accompanied by a demonstration in order to enable the purchaser to properly understand the appliance and its operation. The telephone is another contact point in the interior of the store which can be used to advantage by the enterprising dealer. In addition the personality of the proprietor, the outside employes, the firm's trucks, lantern slides, etc., are important factors of contact with the public.

Under the heading of publications as a point of contact come the mailing lists, distribution of posters and signs, stationery, calendars, advertising pencils, car cards, which are very effective but also rather expensive and display cards and price tags, especially. A great many dealers do not appreciate the value of showing the price of all articles on display. If the price is not marked the public assumes it to be high, whereas, if the price is plainly marked they assume it to be a bargain and are more interested.

In newspaper advertising the text should be timely, forceful, direct and truthful. It should be neat and attractive in appearance and if possible, should always have a distinct white border around it which causes it to stand out better. Special attention should also be given to the position of the advertisement.

Window displays are of course of vital importance. Such displays should be changed frequently and made as attractive as possible, with special attention to the

window lighting. As in interior displays lavender should always be avoided. In illustrating this point miniature display windows were used and the different types of displays shown.

Following Mr. Corcoran, Mr. Goodwin again spoke and requested the frank criticism of those present on any of the ideas presented. The job of merchandising, he explained, was big enough for all to attempt and the field was far from saturated.

In the afternoon a number of athletic events were held in which all present were invited to participate, and a number of valuable prizes were presented.

Repair and Sale of Used Apparatus Section.

On Friday morning two parallel section meetings were held, one by the Repair and Sale of Used Apparatus section and the other by the Merchandising and Fixture Dealing section. A. L. Swanson of Evansville, Ind., presided at the former and Jos. A. Fowler, of Memphis, Tenn., at the latter.

The first address delivered before the Repair and Sale of Used Apparatus section was delivered by A. Penn Denton, of the Denton Engineering & Construction Co., Kansas City, Mo. Mr. Denton's address is reproduced substantially in full in another section of this issue.

This was followed by a paper by A. O. Kuehmsted of the Gregory Electric Co., Chicago, on the "Methods of Determining the Value of Burned Out Apparatus." This concern is one of the oldest and largest handling used electrical apparatus and Mr. Kuehmsted's talk was largely the result of its experiences in this line. The methods of determining the value of any burned out motor or generator, he said, are comparatively simple if sufficient data are provided. The Gregory company has collected these data from three sources and from these data has compiled indexes which have proven of great value in this work. The first of these indexes contains information gathered from catalogs published by the various manufacturers of this equipment which lists the weight and size of the apparatus together with its characteristics.

The second is a card cost system in which is listed the cost of rewinding armatures or fields or refilling and connecting commutators. Each card shows the cost of the raw material, the credit for scrap material, and the labor cost. From these costs on past operations the company can easily ascertain the approximate cost of similar repairs to these machines. It may be of interest to note that the cost of rewinding armatures or fields is practically the same for all makes of the same size and type but the cost of refilling commutators varies in the products of the different manufacturers.

The third index consists of an up-to-date schedule of standard machine prices, the cost to the dealer, the jobber's cost, etc., and from this is based the price which shall be paid for a machine in good condition. However, this price will vary according to the actual age of the machine and whether there is any demand for it or not.

By using these systems the company is able to estimate what any machine is worth. If it is in good condition the offer can be made from the price schedule. If it is in very poor condition, its scrap value can be ascertained by referring to the catalog index which lists the weight of the iron and steel in that particular piece of apparatus. If the commutator needs refilling or the armature or field needs rewinding, the cost of making such repairs can be determined and is deducted from the amount offered for the apparatus.

The company has found that it can afford to purchase used machines for resale that have only one part needing replacement, that is, if the commutator needs refilling, or the armature rewinding or the field rewinding. However, it cannot afford to buy a machine for resale that will require the replacement or repair of any two of these parts except under very unusual conditions, for the repair cost would be too great and therefore only the scrap value can be allowed.

In the discussion of this subject many valuable points were brought out. For example, it was shown that the average price of a second-hand machine in good condition will average 60 to 75% of the cost of a new machine under ordinary circumstances. It was also pointed out that the overhead expense of conducting such enterprises will be from 33⅓ to 50% of the cost.

Mr. Kuehmsted also gave some pertinent advice on guarantee polices which caused considerable favorable comment among those present. The dealer's reputation, in his opinion, is the best guarantee to be given and to guarantee the performance of any apparatus for a certain length of time is inadvisable. The Gregory company ships apparatus which it guarantees to be in good condition when installed and will refund the purchase price and take back the apparatus if it proves unsatisfactory. It will not, however, make any rebate for minor claims arising after the apparatus has been in service.

Following Mr. Kuehmsted, C. M. Jamison, of the Milwaukee Railway & Light Co., explained the policies of that company with regard to appliance repairs. The merchandising department of that company, Mr. Jamison stated, is conducted for profit and he believes its influence is of assistance to the local dealers as it also increases their sales. The minor appliance repairs are made on the customer's premises for which a charge is made. The large repair work is done in the company's shop or distributed to the local repair firms.

Following the presentation of this paper the idea of establishing central repair shops was brought up and discussed. Such shops could more easily carry a stock of parts for all types of appliances than the individual repair shop, for the volume of business would be much greater.

Merchandising and Fixture Dealing Section.

The first speaker at this session was John G. Learned, chairman of the Commercial Section of the National Electric Light Association, who spoke on "Complete Electrical Equipment for the Home." Mr. Learned explained in detail the plans for a nation-wide educational campaign for the purpose of creating a greater demand for complete installations of wiring and appliances in the home which have been developed by the Commercial Section. Mr. Learned's address will be reproduced in full in a later issue.

Phil Polacheck of Milwaukee then described the "Arrangement and Conduct of a Retail Store." Mr. Polacheck recommended that in the electrical retail store the different departments be separated from each other but should be arranged so that any purchaser entering the store can see at a glance all the kinds of merchandise offered for sale. Such departments, for example, as those that sell ordinary supplies such as fuses, sockets, lamps, etc., appliances and fixtures should be distinctly separated but not isolated. Many interesting and valuable suggestions were brought out in this paper and in the very lively discussion that followed. In this way the value of the

various methods of arranging store were clearly shown.

Following this, a paper on the "Relations of the Dealer to the Public in Merchandising" was read by J. R. Tomlinson of Portland, Ore. This paper will also be reproduced in an early issue.

A. L. Oppenheimer of Cleveland, Ohio, delivered an address on the features of fixture business as a part of retailing in which he clearly explained the value of selling lighting fixtures as an adjunct to the sale of appliances and other electrical goods, and described the difficulties frequently met in such endeavors.

Afternoon Session.

At the afternoon session, H. C. Metcalf, Ph. D., of the Bureau of Industrial Research, New York City, delivered a stirring address on "Human Relations in Industry." The subject was especially fitting coming as it did immediately before a discussion on this subject by the association.

Doctor Metcalf described the growth of the human relations idea industry which has resulted in the establishment of personnel or similar divisions in many large concerns throughout the country. In this respect, he stated, the interests of the employe, the employer and the public are practically concurrent if not identical. The loyalty of its employes is a great asset for any concern which, of course, can best be secured by realizing what the employe wants and can reasonably expect to get from his employer. In his opinion, what the employe wants is, first, a knowledge of the firm and his work so that he may be able to select a firm to work for just as the modern employer selects the proper man to work for him; second, security of employment; third, a living wage; fourth, a share in the management; fifth, his own status in the company. The employe also wants the right to organize, but such organizations should be for the purpose of working together. On the other hand, the employers should be willing to experiment in democracy, which means participation. The problem, as Doctor Metcalf sees it, is largely an educational one and ability at the top to recognize and deal with it is the only limit to the expansion of business. However, to establish justice in work relations is the greatest problem to which business can address itself.

During the course of his address Doctor Metcalf referred to "Declaration of Principles" that had been drawn up and which was about to be considered for adoption. In his opinion, this was a big step in the right direction and he complimented the members and the association for their efforts to solve this problem.

The adoption of the "Declaration of Principles," however, met with considerable opposition from some of the members who were skeptical of its purpose and feared lest it should offend those members who do not employ union labor. After considerable lively and interesting discussion in which everyone was given an opportunity to express his opinion and during which an enthusiastic appeal for its adoption was made by Mr. Goodwin, the association voted to adopt this code. The resolution from the Executive Committee and the "Declaration of Principles" as adopted are as follows:

Resolution from Executive Committee to the Nineteenth Annual Convention.

Whereas, The fundamental problem which confronts the business world today is the necessity of establishing relations between men that will make it possible for them to live and work together in harmony and progressive efficiency, and

Whereas, The solution of that problem can be found only through mutual application of infinite patience by employers and employes in co-operative research and education, and

Whereas, No agency for such co-operative work by employer and employe now exists in the electrical contracting industry, and

Whereas, In view of the conditions recited, it is the opinion of the National Executive Committee that the time has come when the National Association of Electrical Contractors and Dealers must change its position of regarding matters of relationship between employer and employe as beyond its legitimate field of activity, and face the fact that the issues now arising and which will continue to arise, involving the very life of industry, and therefore the life of the community, can be settled peacefully only through the faithful co-operation of employers and employes, whose interests in the productive effort are common and inseparable; now, therefore,

Be It Resolved, That the National Executive Committee approve the "Declaration of Principles" presented herewith, and

Be It Further Resolved, That the Executive Committee refer the said Declaration of Principles to the National Association of Electrical Contractors and Dealers, in convention assembled, approve it, and authorize the Executive Committee to act as it may deem best in applying the principles enunciated with a recommendation that a special committee be appointed to act in the matter.

Declaration of Principles—Preamble.

The vital interests of the public and of employe and employer in industry are inseparably bound together. All will benefit by a continuous peaceful operation of the industrial process and the devotion of the means of production to the common good.

Principles.

1. The facilities of the electrical industry for service to the public will be developed and enhanced by recognizing that the overlapping of the functions of the various groups in the industry is wasteful and should be eliminated.
2. Close contact and a mutually sympathetic interest between employe and employer will develop a better working system, which will tend constantly to stimulate production while improving the relationship between employe, employer and the community.
3. Strikes and lockouts are detrimental to the interests alike of employe, employer and the public and should be avoided.
4. Agreements or understandings which are designed to obstruct directly or indirectly the free development of trade or to secure to special groups special privileges and advantages, are subversive of the public interest and cancel the doctrine of equality of rights and opportunity, and should be condemned.
5. The public interest is conserved, hazard to life and property is reduced, and standards of work are improved by fixing an adequate minimum of qualifications in knowledge and experience as a requirement precedent to the right of an individual to engage in the electrical construction industry, and by the rigid inspection of electrical work, old and new.
6. Public welfare, as well as the interests of the trade demands that electrical work be done by the electrical industry.
7. Co-operation between employe and employer acquires constructive power, as both employes and employers become more completely organized.
8. The right of employes and employers in local groups to establish local wage scales and local working rules is recognized and nothing herein is to be construed as infringing that right.

The convention closed on Friday evening following the annual dinner of the association. This proved to be a fitting finale of a most successful convention. James R. Strong, a New York City contractor-dealer, was the song leader on this occasion and although he has filled this position on many former occasions, his efforts at this time were particularly praiseworthy.

Next Convention to Be Held in Baltimore.

Requests for the next convention were received from many cities, which were backed up by the efforts of enthusiastic delegates. After considerable deliberation on this subject the Convention Committee decided to hold the next annual convention in Baltimore, Md., with Oct. 6, 1920, the opening day.

Electricity for Heat Treatment in the Steel Industry

Use for Soaking Pits, Reheating and Annealing Furnaces—Automatic Heat Treatment—Iron and Steel Institute Paper

By THADDEUS F. BAILY

President, The Electric Furnace Co.

THE introduction of electrically heated furnaces to the heating operations subsequent to melting and refining in the steel industry has experienced the slow development incident to the introduction of all radical innovations in any industry. Many of the types that will find wide application in the future, while entirely feasible, have, when offered, been met with the statement that if such an equipment was a good thing, why were they not in general use. Other types that have been in regular service for a considerable number of years whose construction and operation are much more elaborate and whose commercial advantages are no greater, are now generally accepted as the most rugged and reliable equipment for the purpose. This latter refers to electric furnaces for the annealing and heat treatment of steel.

One of these types installed some three years ago has been used exclusively since its installation for the particular material for which it was designed—namely, cast steel draw-bar knuckles—and subsequent to the installation of the first unit, a second unit of the same capacity was installed. This equipment has, since its installation, handled over 50,000 tons of material—approximately half of all the material of this character used on American railroads having passed through these furnaces.

The higher "fuel" cost for electric furnaces over fuel-fired furnaces that might have been used for the same purpose has been amply justified in commercial practice by the labor saving effected, the precision of the treatment produced, and the elimination of the rejections of parts due to defective heat treatment; the precision of the laboratory is obtained in regular plant practice.

There has been a reluctance of manufacturers generally to consider that there is a difference in cost per ton of material put through a furnace and the cost per ton of material heat treated and coming within the specifications. There has been no greater factor in changing this attitude than the conditions brought about during the war, where in a great many plants there was a wide difference between the quantity of material inspected and the quantity of material accepted. Manufacturers now are generally conceding the justness of the higher requirements for steel, and this is one of the greatest arguments in favor of electric furnaces.

Three conspicuous examples of the electric furnace for heat treating are those for Liberty motor crank shafts, over half of which were so heat treated; cast steel anchor chain, all of which was heat treated in furnaces of this character; and draw-bar knuckles, substantly half of those which are used in America being thus heat treated.

These examples are typical of the furnaces to be described in this paper adapted to other operations in the steel industry and embrace soaking pits for the soaking of hot stripped ingots, re-heating furnaces for hot blooms and billets, combination fuel and electric furnaces for the heating of bold blooms and billets, recuperative car type annealing furnaces for bars and sheets, and automatic heat treating equipments for drop forgings and castings and for the heat treatment of steel rails and similar material.

The Electric Soaking Pit.

The electric soaking pit for hot ingots is perhaps the most promising development of the electric furnace to the steel maker, as the shortcomings of the present pits—whether of the fired or non-fired type—are well known, and many troubles of the rolling mill can be traced to the present type of it.

The principal recommendation of the present type of pits, either of the fired or non-fired type, is the low fuel consumption per ton of metal soaked. This cost in a well handled pit is almost a negligible item, amounting frequently to only a few cents a ton.

However, in the larger mills, when running at full capacity, features such as lack of uniformity in temperature of the heated ingot, excessive oxidation of the ingot, etc., are often such as to quite outweigh the item of mere fuel cost, and while it is to be admitted that electric pits cannot compete with fuel-fired pits under ordinary circumstances, when heating cold ingots, the time is not far distant when substantially all modern mills rolling hot ingots will use electric pits for this part of steel mill operation.

It has been difficult to overcome the prejudices against this innovation in ingot soaking, but the advantages to be gained are so apparent and the success of electric furnaces in other similar fields has been so marked, that it will not be long until electric soaking pits will be in commercial operation.

From electric furnaces operating at the same temperature, or at even higher temperatures than that required in soaking pits, and which have been operating over long periods of time, it is apparent that the standby, or wall losses, of a typical pit adapted to hold sixteen 3-ton ingots will not exceed, as a maximum, 1000 kw. and will be expected to operate on considerably less current.

However, taking 1000 kw. as a basis, which is amply safe, and when operating on hot ingots, whose superheated interiors are sufficient to bring to temperature their colder outer shells, and operating on a soaking time of 1½ hours, the capacity per pit will be 32 tons per hour with a figure of 1000 kw. current on the furnace, the current consumption per ton of metal soaked would thus be 35 kw-hr. per ton; taking as a basis of cost of electricity in the steel mill one-half cent per kilowatt, the cost per ton of metal soaked would be 17½ cents, to which might be added a cost

of 5 cents per ton for renewals and repairs, making a total cost of 22½ cents per ton for these two items.

It is to be expected that this cost for heat may be in excess of similar costs for gas-fired pits or unheated pits, but when taking into consideration that the electric pit will eliminate the roll breakages due to cold ingots, delays in the mill due to ingots unevenly heated, oxidation (thus producing a cleaner bloom and an actual saving in metal due to this elimination of oxidation, amounting to perhaps one-half of 1%),

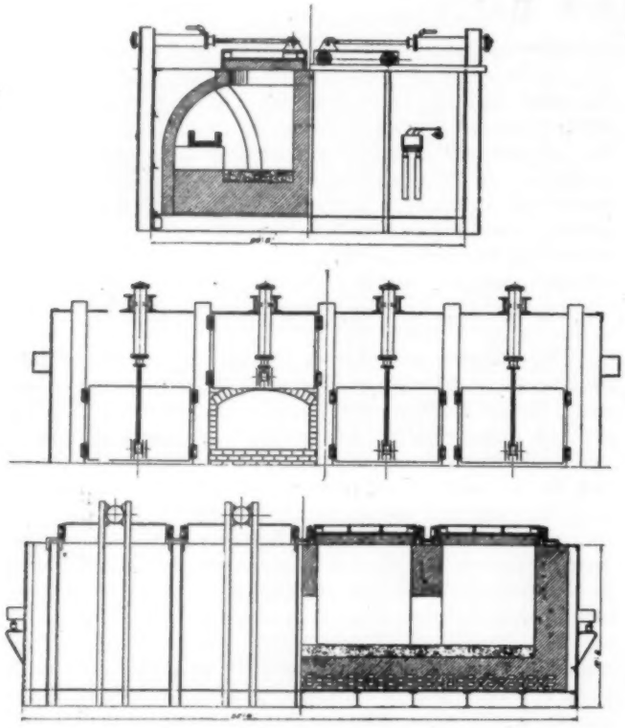


Fig. 1.—Pit Type Furnace for Soaking Ingots for Heavy Forgings and Shafts.

as well as the ability of the electric pit to save labor, it is certain that the higher cost will be more than offset by the advantages, and that per ton of metal rolled in a given period the actual cost by the use of an electric pit will be less than by other means.

Fig. 1 shows the general arrangement and character of such a pit. This pit will be provided with eight holes, instead of the usual four, and in consequence only half as many ingots will be located in each cell.

The resistance elements themselves, composed, as in all furnaces of this class, of broken carbon thrown loosely into a carborundum fire-sand trough supported on brick pillars, are located along the outer wall of each side of the pit and protected against the liability of serious accident from the ingot by being recessed some distance back from the ingot cell itself. The heat from this resistance element, it will be noted, is radiated to the circular wall of the pit and thence to the cover, the partition wall of the pit, and to the ingots themselves. The cross section of this resister element is such that there is very little difference between its temperature and the ruling temperature of the pit, and in actual practice most of the heating is done by the walls of the pit itself, rather than by direct radiation from the resistor element—this being of the highest importance in obtaining uniformity of heating.

In cases where the ingots cannot be delivered to the pit with enough heat for them to reach a high enough temperature without the addition of more heat from the pit itself, a longer time will be required by the ingots to bring them to temperature, and at the same time the capacity of the pit in tons per hour will be reduced.

But taking as a basis ingots whose average temperature would be 1800° F., requiring 300° additional for bringing them to temperature, the capacity of the pit would be reduced to 24 tons per hour, the electrical capacity of the pit increased to 1500 kw. and the current consumption increased to 60 kw-hr. per ton.

With the ingots charged at an average temperature of 1500° F., the capacity of the pit would be reduced to 16 tons per hour, and the current consumption increased to 90 kw-hr. without increasing the electrical capacity beyond 1500 kw.

Thus we have for a total of heating costs, including the renewals and repairs, and with power taken at ½ cent per kw-hr.

Material.	Cents per ton.
Hot ingots	22½
Ingots at 1800° F.....	35
Ingots at 1500° F.....	50

the final temperature in each case being taken as 2100° F.

These figures can be safely taken as guarantees and it can be expected that they will be much bettered in actual practice and operation over long periods of time.

Continuous Type Reheating Furnaces.

It is believed that this type of furnace (Fig. 2) will find wide application in the heating of cold steel for forging and rolling in relatively small capacities and in reheating steel of high quality, but where very large tonnages of cold blooms or billets are to be heated, a combination fuel and electric furnace—to be later described—will be better adaptable for such work.

The illustration on the next page illustrates an all-electric billet heating furnace.

This furnace was built for heating 3¾-in. round billets for shell forgings and while the current cost for supplying this particular furnace was high and the operating conditions not particularly favorable, nevertheless the reduction of rejections of forgings due to eccentricity, the saving of the dies due to the elimination of scale and other advantages, such as better working conditions and simplicity of control, enabled the results to compare favorably with coal-fired practice.

This furnace was of 600-kw. capacity and in actual practice handled 1½ tons of steel per hour, with a current consumption of a little over 450 kw-hr. per ton or a thermal efficiency of a little more than 50%. Under more favorable conditions, an efficiency of 66%, or a current consumption of approximately 300 kw-hr. per ton has been obtained. So that with low cost of current, which it is believed may be taken as ½ cent per kw-hr. in steel mill power costs, the "fuel" cost for cold heating in units of this size would be $1.50 per ton.

This cost will compare favorably with direct coal-fired furnaces of similar capacity and will actually show some commercial advantage when taking into consideration the saving in metal due to scaling, which may readily run several per cent and at least in aver-

age operating conditions may be taken as 2% and under the worst conditions 5%, actually observed in one or two instances.

Furnaces of larger capacity than the one described show a less favorable comparison to the electric and furnaces of smaller capacity show a more advantageous comparison with the electric furnace, and it is believed that in any case, the cost of material heated in furnaces of this size, all things considered, may be safely taken as running very close together, with the electric furnace having the advantage in greater uniformity of temperature and other incidental advantages, including a higher yield of good finished pieces.

An application that it is believed will find favor in certain steel mill operations is the use of an electric furnace for re-heating billets for finishing mills,

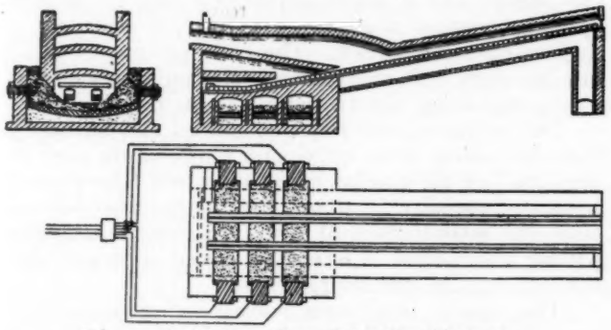


Fig. 2.—Continuous Type Reheating Furnace.

wherein the blooms or billets coming from one mill are too cold to put into the finishing mill and will require approximately 200° additional heat.

The calculations on such an equipment are as follows for a capacity of 15 tons of 4-in. square billets per hour, charged into furnaces at 1800° F. and brought to 2000° F. Such a furnace would require 800 kw. current for its operation and somewhat under 60 kw-hr. per ton of metal re-heated, and with ½ cent for power, making a cost of 30 cents per ton of metal re-heated. As an electric furnace of this character would undoubtedly save one-fourth of 1% of metal over fuel-fired furnaces, which would amount on steel worth $40 per ton to a saving of 10 cents per ton, and then taking into consideration the low efficiency to be expected of a fuel-fired furnace of this character operating on hot billets only, there would be a decided advantage in the use of the electric furnace for such an operation.

Combination Fuel and Electric Reheating Furnaces.

Where large tonnages of cold blooms and billets are to be heated, however, unless electricity can be obtained at an exceptionally low rate and fuel can only be had at a high cost, a combination gas and electric furnace (Fig. 2), wherein the earlier stages of the heating up to, say, 1800° F. are handled by fuel, and the final temperature handled electrically is perhaps the only type that can compete with the continuous fuel-fired billet heating furnace.

Such a combination would enable the preliminary heating to be done with fuel, without the danger of excessive oxidation that is present in the fuel-fired billet heating furnace, and will insure a uniformity in the heating of the billets that is not generally obtainable in fuel-fired furnaces of this type, and while there would be a small saving of perhaps 50 lb. of coal per ton of metal heated due to the lower temperature to which the billets are heated by the fuel-fired end, against this must be charged, say, 60 kw-hr. per ton of metal or 30 cents per ton of metal heated for the final stage by electricity; nevertheless, the advantage of uniformity in temperature, elimination of scale, etc., and more accurate control will justify in many cases the use of such a combination furnace.

Annealing Furnaces.

Of the annealing furnaces in the steel industry, the recuperative car type will have perhaps the widest application. Two furnaces of this type are now under construction. The largest of these will have a capacity of 150 tons per day when annealing at 1200° F. and is adapted for the annealing of cold-rolled strip and sheets. The second furnace, though having approximately the same dimensions, will be for annealing alloy steel bars, which require a long soaking time at maximum temperature.

The first of these furnaces is shown in Fig. 3. One notable feature of these furnaces is that the annealing will be done without the usual covers required in fuel-fired furnaces ordinarily used for this work, which will constitute one of the greatest savings in annealing, as compared with present methods. This recuperative type furnace lends itself to the highest

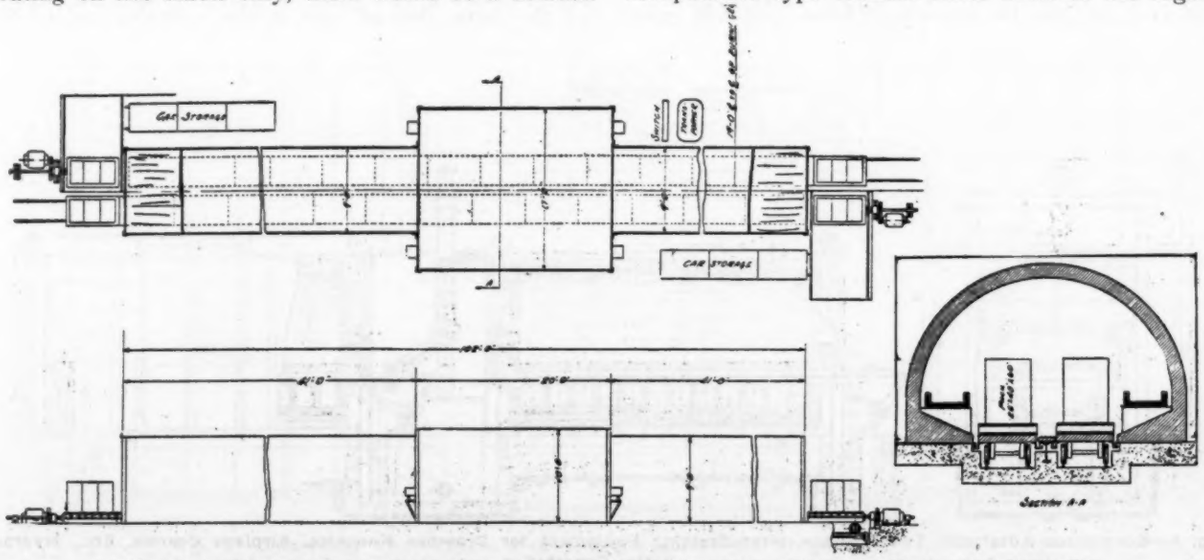


Fig. 3.—Continuous Recuperative Cary Type Furnace for Annealing Tin Plate, Cold-rolled Steel, Etc.

economy, as after the steel has reached the full temperature and is passing toward the discharge end of the furnace, a large part of this heat is given up to the cold incoming material.

In the preliminary trials of the first of these furnaces, excellent annealing results were obtained as well as high economy, but difficulty was experienced with the equipment from the standpoint of complete elimination of oxidation, due to a lack of proper precaution at the ends of the furnace. This matter, however, is one readily overcome and this equipment will soon be in regular operation.

The equipment illustrated in Fig. 3 is of 600 kw. electrical capacity and is approximately 225 ft. long by 22 ft. wide. The material is handled on sand-sealed cars, each car being substantially 13 ft. long by 4 ft. wide and adapted to hold 20 tons of material, there being in all 17 cars located on each of the two lines of track passing through the furnace, each line of cars passing in opposite directions. In the middle of the furnace is located the heating chamber proper, which is 26 ft. long, holding two cars in the heating zone on each track at a time or substantially 80 tons of material at a time in the heating chamber.

A movement of the cars takes place on each track approximately every 6 hours, discharging at that time two 20-ton cars of material, one at each end of the furnace, and similarly charging at each end of the furnace a car of cold material. The cars are moved forward by means of a hydraulic machine, operated by a 600-lb. water pressure system.

One of the requirements of this equipment is that when annealing low-carbon cold-rolled strip, the hardness should not exceed 20 sceleroscope measurement. All of the tests taken were between 18 and 19.

While no tests for maximum capacity could be taken at the time owing to sufficient steel not being available, the operation at half capacity was well within 200 kw-hr. per ton, which clearly indicated that when operating at full capacity the current consumption would be somewhat under 120 kw-hr. per ton.

Taking again large steel mill practice of current at ½ cent per kilowatt, the cost of annealing in this type of furnace would not exceed 60 cents per ton, which will compare favorably with coal-fired annealing furnaces from a fuel standpoint, and in addition will completely eliminate the expense of covers, as well as a considerable amount of labor, and will introduce a precision in annealing which it is not possible to obtain with present equipment.

The other equipment of this character, although of approximately the same dimensions, excepting being somewhat shorter in length, requires a larger heating chamber proper, even though the rated capacity is only 75 tons per day. This is due to the fact that the metallurgical requirements are such on the alloy steel to be treated that the material must be soaked for 40 hours at a maximum temperature of 1400° F.

The furnace itself is supplied with 800 kw. transformer capacity and will operate with a current consumption something under 250 kw-hr. per ton of metal annealed. In this furnace ten 15-ft. cars, each holding 30 tons of material, are located on each of the two tracks, and a maximum of 600 tons of material is in the furnace at a time, 120 tons of which are in the heating zone proper. The full movement of each line of cars will take place substantially every 20 hours, delivering substantially 72 tons per day.

One of the special requirements of this furnace is that the cooling from maximum temperature over the first 200° of the cooling range must not take place at a greater rapidity than 10° per hour. This necessitates the introduction of a very powerful and slow pulling mechanism wherein the speed of travel does not exceed 9 in. per hour.

This special equipment consists of a motor-operated chain haul similar to the equipment used in the larger types of draw benches for tube drawing, and is supplied with a 10-hp. motor through seven gear reductions. As the cars must pass through a sealed entrance hood or chamber before going into the furnace proper, this precaution being found necessary in order to prevent reducing the atmosphere of the furnace during charging, the pushing mechanism and the door operating mechanism are interlocked so that when the push button starter is operated the interlocking mechanism first raises the door of the entrance hood, then the cold car of material is pushed into the chamber, the entrance door closed, the door to the main furnace next opened, the pusher continuing the push of the car just far enough into the entrance hood until it comes in contact with the main line of cars in the furnace. From this point on the travel is at the rate previously mentioned, namely 9 in. per hour, during which time the door at the discharge end of the same line of cars at the opposite end of the

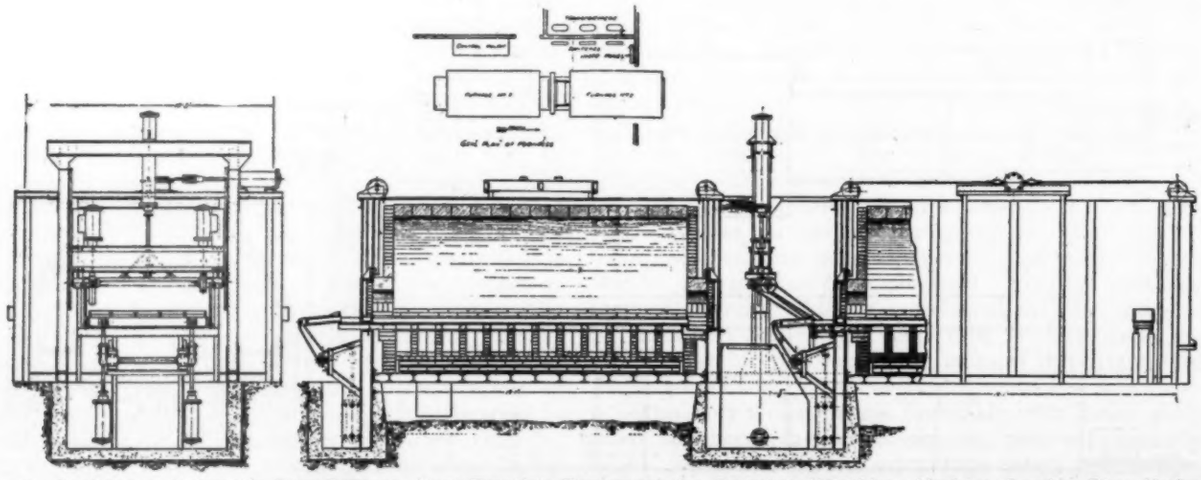


Fig. 4.—Continuous Automatic Two-Furnace, Heat-Treating Equipment for Drawbar Knuckles, Airplane Cranks, Etc., Hydraulically Operated.

furnace is opened and the car at the discharge end moved into the cooling hood at that end, the discharge door on the vestibule itself still being closed. When the cold car being pulled in has come fully within the door line of the furnace proper, the door is dropped behind it and the heating chamber thus sealed.

At this point, the pushing dog behind the car is reversed and it is returned to its starting position to bring another car into the entrance hood. While doing so, however, a pull-out chain, operated by the same shaft as the main pulling drum, latches, through means of a special dog, into the car of cooled material on the opposite track, moving it a few inches forward from the line of cars that has pushed it to the discharge position, then the interlocking mechanism drops the door in front of the line of cars, after which the outer door of the vestibule is opened and the drawback mechanism pulls the car entirely clear of the furnace, at which time the door of the vestibule is closed. Immediately following this operation a similar operation to the one just described begins at the opposite end of the furnace, the chamber and the furnace proper being first opened.

Heat Treating Equipments.

It is, however, in heat treating equipments—which consist of two furnaces, one for the hardening temperature and one for the drawing temperature, in connection with a quenching mechanism located between —that electric furnaces have been first recognized as standard equipment for exacting work in the steel industry, and the earlier of these furnaces, especially of the automatic type, have been in use now for several years.

One of the most notable of these is an installation made at Sharon, Pa., over four years ago which the following year was augmented by a duplicate installation.

A similar equipment of the same capacity was installed last year for the heat treatment of crank shafts for the 12-cylinder Liberty airplane motor. This equipment is shown in Fig. 4. On account of the irregular shape of the material under treatment and also to enable other sizes and types of airplane shafts to be handled interchangeably, a special type of cast steel chair was developed so that the direct force of the pushers brought against a line of these chairs, the material to be heated thus lying independent and free from strain while going through the furnace.

The steel used in these crank shafts was perhaps one of the most difficult to heat treat, and the requirements were most exacting. Opportunity for obtaining the exactness of this treatment was in this case readily available, as test pieces were taken from each end of every piece, and it is interesting to note in connection with this rigid inspection that for days at a time, when producing even several hundred cranks a day, there would not be a single rejection for any cause. This fact not only speaks well for the heat treating equipment but for all the previous operations in connection with the steel, including the forging, heating for forging and the making of the steel itself.

Anchor Chain Heat Treating Furnaces.

A heat treating equipment of similar capacity but with a modification as to handling mechanism is installed at the plant of the National Malleable Castings Co., Cleveland, Ohio, for the heat treatment of cast steel anchor chain. This consists of a 600-kw. hardening furnace, approximately 28 ft. long by 16 ft. wide, and a hearth the full length of the furnace and 6 ft. 6 in. wide. At the discharge end of this furnace is located a concrete quenching tank, 40 ft. long by 8 ft. wide, for quenching the chain. At the other end of this pit is a furnace of similar size but of 300-kw. capacity for drawing the temperature of the chain after quenching. Each of these equipments has a rated capacity of 50 tons of chain per day and the current consumption when operating at capacity is substantially 450 kw-hr. per ton, this current consumption being 150 kw-hr. per ton higher than in the other heat treating furnace just described and than the two similar sets at the same company's Sharon plant, due to the fact that the material is such that a larger furnace chamber was required for a given capacity. (Fig. 5.)

The charge of material consists of two 90-ft. lengths of 2-in. cast steel anchor chain, folded into loops 22 ft. long. These loops are dropped over heavy cast steel hooks, the ends of which, when the charge is in the furnace, protrude through recesses cut in the furnace door. The ends of these hooks are connected to a heavy steel cross bar, which is provided with lugs for fastening on the pulling chains, operated by a heavy winch, similar to a crane drum and equipped with a 20-hp. motor. One of these winches is located 30 ft. beyond the discharge end of the drawing furnace, the other directly over the quenching pit.

The operation of heat treating these chains begins

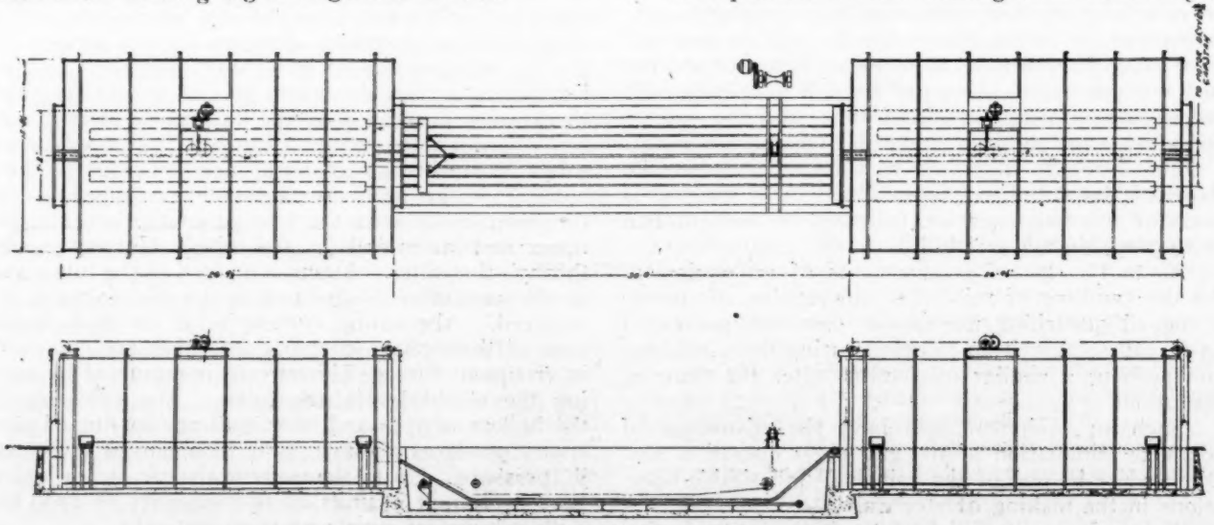


Fig. 5.—Continuous Two-Furnace Heat-Treating Equipment for Cast-Steel Anchor Chains.

by dropping the loops of the folded chain over the hooks in front of the charging end of the hardening furnace, the hearth of the furnace being level with the foundry floor. The pulling chains are dragged through the hardening furnace from the front end by means of a light iron bar, the winding drum backing off the chain as it is pulled through. These chains are now hooked onto the steel cross bar of the cast steel hooks just mentioned, the winch reversed and the chain pulled into the hardening furnace, where it remains for substantially 2 hours, during which time it is fully and entirely heated to the furnace temperature, which is about 1650° F. The doors of the hardening furnace are then opened and the winch pulls the chain out of the furnace into the quenching pit, where it lies on a steel framework composed of 7-in. channels. As the chain is immersed into the quench it is met by a strong flow of fresh water from submerged nozzles so as to give it an initial chilling, directly as it is immersed. As the tail ends of these chains pass out of the furnace door, the door closes and the chain is allowed to lie in the quench for several minutes. Before it is completely cooled, however, the chains from the winch of the second furnace are dragged through that furnace and hooked into the cross member and hooks holding the chain in the quench. The pulling chains from the first furnace are disconnected, the doors of the second furnace are opened and the winch of the second furnace pulls the chain into the drawing furnace, where it remains for another two hours and is subsequently and in a similar manner withdrawn from that furnace.

Large heat treating furnaces of the automatic type such as are described in this paper, whose certainty of operation and precision of treatment have been clearly observed over several years, justify the consideration of the heat treatment of large tonnages of heavy material, such as steel rails. The building of equipments for such purposes presents no serious difficulty.

It is readily apparent to anyone interested in this subject that the heat treatment of rails is highly desirable, as the increased physical properties readily obtainable by a proper heat treatment are such as to very remarkably increase their efficiency, not only adding to the life fom the standpoint of wear, but adding materially to the ultimate strength and the elastic limit, without appreciably sacrificing the ductility or toughness, and the only real question that can be raised is whether successful heat treating equipments can be found wherein every rail treated will have exactly the heat treatment specified, and whether such equipment can be rugged enough to operate with precision over long periods of time, and the cost of operation come within a reasonable commercial range.

The furnaces described in this paper, especially those of the automatic type, which have records of years of successful service, fully answer the question as to precision and reliability.

As to the special requirements of an equipment for the handling of rails, this will require, of course, a rugged quenching mechanism that will prevent a 33-ft. rail section from twisting during the quenching and perhaps a similar mechanism after the drawing operation.

Such an equipment will have the advantage of complete elimination of the gag press operation now admitted to be one of the principal undesirable operations in the making of steel rails.

As to the commercial cost of the heat treating operation, as compared with the increased physical properties, it may be stated that the actual cost for electric heat under the conditions named in this paper would not exceed $1.50 per ton, and the labor cost would probably be no more, and perhaps less, than is now required in the straightening press operation above referred to. The ultimate strength of the rail would in all probability be increased more than 25% and the elastic limit perhaps doubled, while the life of the rail from a wearing standpoint would undoubtedly be materially increased. It is a conservative statement to say that a 25 to 50% more effective rail from a wear and safety standpoint could thus be obtained at an additional cost per ton of not to exceed 5%.

The equipments described in the latter part of this paper are the forerunners of electric furnaces of the type that will soon come into regular use for operations on a far larger scale than will generally be conceded by the average steelmaker today and will embrace the wide and almost exclusive use of certain types, such as the soaking pit and certain forms of the re-heating furnace first mentioned in this paper. While in some cases there will be an actual reduction in cost of operation over present methods due to the electric furnace, even for steel of average quality, the more rigid requirements in finished product will in some cases compel the use of electric furnaces.

Where requirements of the steel specified must be met, a lower cost may readily be found in operating electric furnaces, when taking into consideration the difference between the cost per ton of material put through the furnace, as compared with the cost per ton of material meeting the specifications.

Many of the arguments used against the introduction of electric furnaces were used against the introduction of large motors in the steel mills and against electric haulage, and the statements frequently made through all the years about any innovation that "it has not been done and it cannot be done" must gradually yield, as one by one the various types of electric furnaces from heat treating equipments to soaking pits go into regular, commercial service.

ELECTRICALLY HEATED STEAM BOILERS.

Under certain special circumstances the electrical heating of boilers is justifiable; for instance, in very northerly countries, for the wood pulp and paper factories with water-power driven machinery, which requires large quantities of steam for the process.

The Allegemeine Elektricitäts Gesellschaft of Berlin, Germany, has developed special boilers in which the heating is effected by the passage of electric currents through the water. For this purpose narrow tubes of insulating material are provided. These contain water and are vertically arranged so as to communicate with the interior of the boiler at the upper and lower ends of the tubes. Current is sent through the water columns contained in the tubes and, as the resistance is great, considerable voltages are required. Alternating current must be used, in the case of three-phase currents the tubes are connected in groups of three. The current is regulated by moving the electrodes in the tubes. The efficiency of the boilers is 95% and over, and one kw-hr. of electricity produces about 2.75 lb. of steam at 90 to 120 lb. pressure. Up to the present electric steam boilers have been built in units up to a capacity of 1500 kw. with voltages of supply up to 10,000 volts.

Service Tests of Small-Capacity Meters

Schedules of Tests—Experiences as to Errors—Paper Before Ohio Electric Light Association

By ARTHUR HORACE BRYANT

Meter Engineer, Cleveland Electric Illuminating Co.

FIVE years ago our business, like that of many other industries, was getting along very satisfactorily on the whole. To be sure, there was always a changing condition to be foreseen, and there was the ever present problem of labor and its various moods, its restlessness and consequent "turn over" with the continual question of how best to select and keep efficient workers—for hereupon rests the success of any enterprise. However, the aims and purposes of our lives and business were being worked out without any very serious obstacles or challenges, when suddenly and before we could realize what it all meant, we were confronted with the world at war. First, we assured ourselves that we were safe and could go about business with little or no interference. But soon we too had cast aside as non-essential everything that was not contributing in some measure toward the winning of the war and we entered into the spirit of the day. Men all about us—employes of experience and those who could ill be spared—left to others their responsibilities and set out to help in the larger work of the country. Help became scarce, wages and material commenced to climb in price: you know full well how the central stations were ofttimes taxed to their limits to meet the increased demand for more power; their business boomed. However, the added work had to be accomplished by fewer men at a greater cost and this was capped with an increased scarcity and poorer quality of coal, not to mention other needful supplies. The rates having been fixed and contracts for most services having been given on a peace-time basis, and with no upward revision possible except at the approval of the Public Commission—representing a public already exasperated with uncontrollable advances of almost everything needful to life—and with a money market tight, the central stations found themselves in anything but an enviable position. Nevertheless, the war had to be won no matter to what extent the sacrifice, and the central stations were an important element in the industrial performance of this task. All non-essentials had to be cut out or deferred; even many things that previously had been looked upon as essential had to be set aside for the time. Periodic testing of meters was one thing that could thus be deferred and the labor and expense thereby relieved could be used to fill in the dangerously yawning gap in departments with more imperative needs.

All periodic testing, however, could not be deferred without more or less irreparable losses in revenue. In the case of the residence class meter, however we have not only the largest percentage of the total number of meters, involving a large share of the cost of maintenance, but therefrom is derived the smaller percentage of the total revenue. Consequently, in practically every large central station the periodic testing of residence or smaller capacity induction meters has been partially or entirely discontinued for the period of the war, with exception of such necessary tests as are required by complaint investigations or on account of verification of questionable registrations at the request of the billing or accounting departments.

Now that the armistice has been signed and war activities are rapidly declining, we are fast approaching or have already arrived at the time when we must again pick up the work which was temporarily deferred. However, we have in the meantime come to look upon many things in a new light and from a broader experience, so that we are asking ourselves and one another: What changes should be inaugurated and what improvements are possible? We do not wish to return to the pre-war methods and conditions except insofar as such shall be found to be the best and most satisfactory.

Since we are finding meters with extended periods between periodic tests still registering their loads within their required limits, such questions as these naturally confront us: How much longer could these service periods between periodic tests be extended without the occurrence of serious errors? What should we try to establish as the most suitable period between tests?

If such a period can be safely extended one or two years, say, from three years to four, or even five years, it would decrease the costs of such tests from 35 to 40%. Assuming for the moment that this saving thus made should be but half this amount, it represents an economy well worth the consideration of every central-station company.

One large central station to our knowledge has at the present time over double the number of meters in service to that of five years ago. In contrast with this, the total number of meters tested this past year was less than 40% of the number tested five years ago. Even if, with the return of peace conditions, this company were to receive back all the testers it has lost—which cannot be expected—it would fall far short of what would be required to maintain its pre war schedule of tests. It takes time to secure and properly train men to the point where they are capable of handling satisfactorily the tests on customer's premises. What should we recommend to this company and others similarly situated when they come to us for advice?

Should we recommend extending the intervals between tests of the smaller capacity induction meters to—shall we say five years or what?

Should we include in this recommendation all modern makes and types of induction meters or ought we to qualify this in certain cases?

Should we recommend that an inspection with an

approximate load test be made after, say, 60 to 75% of this period has elapsed?

Should we recommend a careful consideration of all meters in this classification which show a questionable deviation from the normal monthly registration to be followed up with a test if a satisfactory explanation is not readily obtained therefor?

Should we advise the changing of meters within this class for laboratory or shop tests where the operating company shall find itself incapable of making service tests after an elapse of, shall we say ..... years? Is this latter method going to prove acceptable to the company or customer as representing the service accuracy of such a meter?

Should we strive to maintain the small capacity induction meters within the same limit of accuracy as those involving larger revenues? If not, what should be the limit? Note: The cost per test differs but little between the meter with a monthly average revenue of but $2 to $3 from that which runs into hundreds of dollars a month. A 5% error in the first case represents a loss in revenue very much less than 1% in the latter.

Do some makes and types of meters have causes of error different from those of other makes and types? If so, would it not be advisable to establish the interval of service between period tests, taking also into account the type and capacity of the meters involved, rather than to base the same on the meter capacity only, irrespective of type Should the average cost of test and the approximate average yearly revenue have any influence in the establishment of the service period between periodic tests? If so, how should the same be applied?

With such questions as these in mind, the writer desiring to ascertain what might be the status of some of the larger central stations in respect to some of these matters, prepared a simple questionnaire which he sent to 12 meter superintendents in various parts of the country. Nine replies were received which, together with the writer's, makes ten. Following is an attempt to summarize their questions and answers:

(1) Regarding the normal pre-war intervals between periodic tests in the case of the smaller capacity induction meters: Two reported that they had been following a 24-month schedule. One reported that they had been following a 30-month schedule. Six reported they followed a 36-month schedule.

(2) The question was asked as to why these particular schedules were adopted rather than some other. The answers were quite varied in nature. Two attempted no answers at all; one, who reported a 24-month schedule for small a. c. meters, replied that when the schedule was adopted there were several new types of meters being placed in service, and they were somewhat apprehensive of their performance over a long period of time, so they felt that a test at least every two years was warranted from the point of being assured that they were properly maintaining the meter accuracy. Another states that their schedule (a 36-month) was adopted because a great many other companies had adopted this same time interval for small capacity residence type a. c. meters. Two laid the burden upon the State Commission, claiming that the schedule for residential meters was adopted by their Public Utility Commission, "probably after comparison with other commission rules and investigation regarding the performance of meters." Still others reported that in the case of a. c. meters the schedule was not originally established on any definite basis so far as the accuracy of the meter is concerned, but it was started on the theory that all meters should be tested once a year, but this was soon found to be unnecessarily often, due to the large number of O. K. tests; so that this schedule was accordingly lengthened as far as it was thought to be safe considering the accuracy obtained and revenue derived from these meters.

(3) Answers to the question whether it had been possible to maintain these schedules uninterruptedly up to the first of this year shows that in the case of each of the ten reported, none had been able to maintain such schedules, while at least four stated that they had practically abandoned for the time being all periodic testing of residence meters, one adding that "the Billing Department kept a pretty strict watch over the monthly bills for the small customers, and when the bills showed any abnormal fluctuation from either the previous month or the corresponding month of the previous year, they made a special investigation, and in case they were unable to discover anything which satisfactorily accounted for some fluctuation, they tested the meter."

(4) As to the intention to return to the pre-war schedules of testing residence meters, four replied to the effect that such was their intention. One replied that they contemplated trying to have their schedule for small capacity induction meters changed from 30 and 36 months, giving as their reason that they thought these meters would give good results on the longer schedule. Three replied that they did not contemplate returning to their pre-war schedule. It is the opinion of the writer that these latter were not so required by their State Commissions while the others were.

(5) With a view of ascertaining if there might be any approximate relation between the error occurring in a meter and the million of turns of the moving element, the question was asked: "Have you any data showing the relation between shaft turn of the moving element and the relative accuracy of the meter registration?" Seven answered that they had no data on this subject. One sent curves made up which showed that when but a few meters were considered, the relation seemed to be rather erratic.

I would like to quote from the reply of one who has evidently given this matter considerable thought and study, in which he writes: "It is rather difficult to obtain any definite relation between shaft turns of the moving element and the relative accuracy of registration. With sapphire jewels, the jewel has a very considerable influence on the accuracy of the meter but the curve of deterioration is not a straight line. We found that our accuracy was very much improved by arbitrarily removing sapphire jewels at each periodic test and having them repolished, and our schedule was made, as before mentioned, largely upon the expected life of the jewel." (The reference thus referred to is: "The d. c. schedule was based originally on the basis of revolution of the disc, as at that time we were using sapphire jewels which had a considerable influence on the sustained accuracy of the meter. We are now using diamond jewels but are still retaining the 12 months' limit of these meters and unless the use is very light, I do not believe it wise to lengthen it.")

Continuing, he adds: "It made considerable difference in the wear of the jewel, whether the meter was running at high speed or at a comparatively low rate With diamond jewels the deterioration is practically all in the shaft end, and compared with the other sources of trouble, is practically negligible. From the data I have compiled on the C. S. type of meter, the deterioration in accuracy seems to be a function of the time the meter is in service, or rather the time between

periodic tests rather than a function of revolution; but the rate of change is not sufficiently uniform in the meters so far tabulated to allow us to base our test accurately even on this factor. With the a. c. meter, from the little data we have compiled to date, there does not appear to be any relation whatever in actual practice between the sustained accuracy and the length of time between periodic tests. In other words, the average accuracy of a block of meters allowed to run 48 months appears to be practically the same as that of a similar block of meters allowed to run 12 to 24 months. We are compiling data of this, but as yet have not enough available to make showing conclusive."

The writer has been compiling data covering several hundred meters grouped according to make and type. His data bears out the conclusion expressed in the above to the effect that it thus far affords little upon which to help establish an efficient interval between periodic tests. Probably the most striking conclusion to be reached from this compilation is that no period was reached which showed a decided tendency for deterioration of accuracy. Possibly when the tests cover longer intervals between tests, this characteristic may appear.

(6) The last question in the questionnaire, previously referred to, aimed to bring out, if possible, some relation between the average cost of testing and the average revenue derived from any class of meters, it read: "Do you consider it practical to try to establish the test period by taking into consideration the average cost of test and the approximate value of revenue saved through corrected accuracy" In answer to this, the party previously quoted writes: "In spite of what I have said in the foregoing, I think that for d. c. meters approximate curves of increasing errors could be had that would give some indication of the errors to be expected under certain conditions and that it would be possible to apply these curves, taking into consideration the average cost of test and the approximate value of revenue involved through correction of accuracy, to make it worth while. It would be considerably more complicated than our present method of arriving at test periods. For meters that are outside of what would be commonly known as small use meters we have used for years a method which roughly approximates this idea, but in addition meters which show a decided tendency to fall off in accuracy, due to either its location or to the use to which it is put, the period is shortened. One complication with a. c. meters is, of course, the weakening of the magnet which can hardly be allowed for." Another answer reads: "From our data I do not believe it is practical for us to test meters on the basis of shaft revolutions. There is one weakness I see in this method. Most full load errors are due to change in magnet strength due to aging or short circuits. This has no bearing on shaft revolution." This has been brought forcibly to my attention on the test we are now making of meters which we had extended to the four-year plan." Still another writes: "We feel as though satisfactory results can be obtained by arranging a test schedule primarily based on the capacity of meter." Contrasted from this, showing considerable diversity of opinion expressed, another writes: "The average cost per test and the approximate revenue saved to correct its accuracy should be considered in making up a test schedule, but consideration should also be given to maintaining meter accuracy. By this I mean that I consider it good policy to set a time interval whereby we test the meter before the revenue commences to decrease because of slow meter, then to set a time interval whereby we are almost certain to find meter running slow."

The general conclusion gathered from these very interesting replies are as follows:

(1) The pre-war schedule for periodic tests of the smaller capacity induction meters was in most cases 36 months. No longer periods have been indicated.

(2) A few, if any, of the larger central stations were able to maintain this schedule for this class of meters during the war. A number of companies practically abandoned periodic tests on meters of this class during the war time conditions.

(3-4) Those companies operating under State Commissions, which have adopted definite ruling pertaining to the testing of meters of this class, are endeavoring to return as rapidly as possible to their former schedule of tests.

Those companies operating under more liberal ruling are not contemplating, for the present at least, the return of their pre-war schedule for this class of meter. The reason for this change seems to be based on the opinion that tests made after extended periods show no increased tendency to error over those taken after the previously shorter periods.

(5-6) Little or no effort appears to have been made to arrive at a period between periodic tests for meters of smaller capacity from an analytical, systematic or economical basis.

After considering the problem of extended intervals between periodic tests, I would like to present the following suggestions for your consideration:

Since the general accepted period between periodic tests on the residence class a. c. meters is given as 36 months and since it is the expressed opinion of not a few that this period can be safely extended by one or two years, I accordingly would recommend:

(1) That a thorough inspection be made in place of usual 36-month test and that where the inspection raises no question as to the accuracy of any given meter, its test be set at 60 months (24 months after the inspection).

(2) The adoption of the following, where it is not already the established policy, to the effect that all cases of unusual changes in monthly registration be investigated and where there shall be no satisfactory explanation therefor, that a thorough inspection or test be made at once.

(3) That the inspections above referred to (Sec. 2) should cover:

(a) General external conditions, such as condition of wiring, seals, etc.

(b) Approximate stop-watch or whatever standard check of the meter on a standardized 60-watt load.

(c) Where this check shall show the meter accuracy to be within 4%, the meter may be opened, the jewel cleaned and oiled or replaced when rough. The top bearings of such meters as show characteristic friction at this point may be cleaned and oiled, the magnets and disc cleared from any foreign matter.

(d) The meter to be again sealed, daily reading recorded.

(e) Where the 60-watt test shows the meter to be found in error over 4 or 5%, the meter should be again checked on this load after general inspection and cleaning. If it still is shown to be over 4% in error, the meter should be scheduled for test.

(f) Normally the last feature of this inspection should be a 10-watt or starting load taken to insure that the meter has no serious light load error.

CHAIN TRANSMISSION IN NEVADA MILL.

Eight Tube Mills and Several Auxiliary Machines Electrically Driven Through Chains in Ore Mill.

Mining and metallurgical companies in the Pacific coast and inter-mountain states were among the first of industrial concerns to adopt electric drive with silent-chain transmission for the operation of power and milling equipment.

While the problems of transmitting power are practically the same in all the industries, the data and illustration given herein show the special adaptability of that type of transmission to the driving of tube mills, conveyors and centrifugal pumps in ore-reduction plants. They relate especially to the equipment in the plant of Tonopah-Belmont Development Co., Tonopah, Nev., in which gold and silver ores are pulverized to a very fine state preparatory to treatment by the cyanide and flotation processes. This mill contains eight Allis-Chalmers tube mills, each 5 ft. by 18 ft., and driven at a speed of 30 r.p.m.

The tube mills are operated in four different units, each unit of two mills being driven by a 100-hp. motor running at 570 r.p.m., with Morse silent chains for transmitting the power. Two chain drives are required for each tube-mill unit. One of these connects the motor to a countershaft, while the other connects the two countershafts together. Each mill is controlled through a friction clutch coupling, making it possible for the two mills to be operated singly, or both at the same time. The arrangement of a tube-mill unit, with motor and silent-chain connections, is well shown in the illustration at the bottom of the page.

A summarization of the Morse silent-chain installations in this mill is as follows:

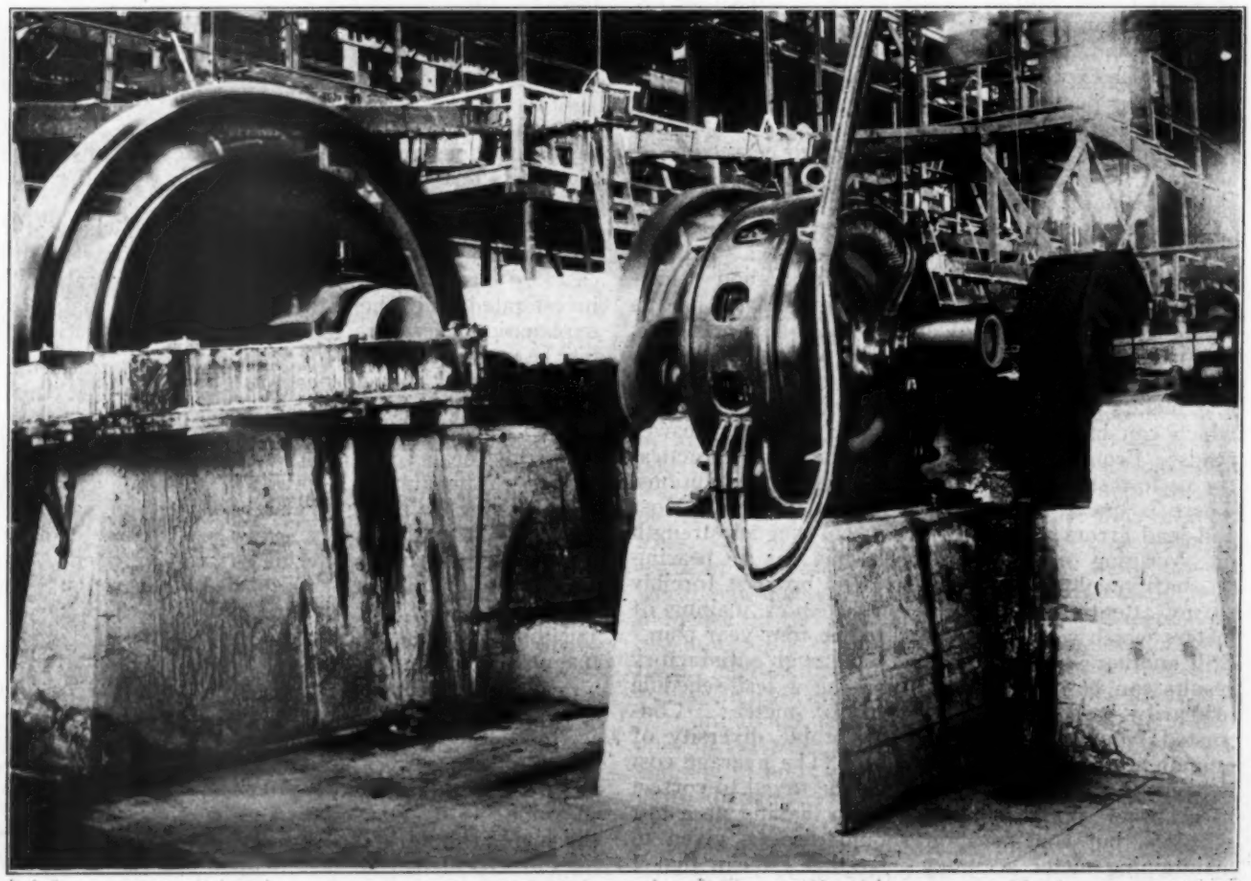
Four 100-hp. drives, 570-162 r.p.m., 48-in. centers, each made up of one 19-tooth driving sprocket, 9.06-in. diameter; one 67-tooth driven sprocket, 32.26-in. diameter, and one chain 13.75 ft. long, 10 in. wide, and 1½-in. pitch. Also four 100-hp. drives, operating at speed of 162-162 r.p.m., 40-in. centers, each having one 53-tooth driving sprocket, 34.13-in. diameter, and a driven sprocket of 53 teeth and same diameter; the chain in each drive being 15.67 ft. long, 6 in. wide, and 2-in. pitch.

There are other motor drives in this mill for which silent-chain transmission is employed. One of these consists of a 15-hp. drive, 860-113 r.p.m., 56-in. centers, with a 4.87-in., 17-tooth driving sprocket; and a 37.14-in., 129-tooth driven sprocket; one chain 15.3 ft. long, 3 in. wide, and 9/10-in. pitch. This is for operating a conveyor.

Another 15-hp. motor drive, with silent-chain belt connecting with a Krogh centrifugal pump, has a speed of 1150-1000 r.p.m., requiring a 6.29-in., 31-tooth driving sprocket, and a 7.09 in., 35-tooth driven sprocket, on which operates a chain 4.8 ft. long, 4 in. wide, and ⅝-in. pitch.

While this type of chain drive is positive, there is sufficient flexibility to relieve the motor and the driven machines from vibration; and the sustained efficiency is understood to reach 98.6% or higher.

The installations described were made in 1912, and this is one of the most complete milling plants in Nevada.



View of Tube-Mill Unit in Mill of Tonopah-Belmont Development Co., Showing 100-Hp. Motor Drive, With Morse Chain Transmission.

Editorial Comment

Parallel Sessions at Contractor-Dealer Conventions

ONE of the most interesting and instructive sessions at the recent annual convention of the National Association of Electrical Contractors and Dealers was that of the Repair and Sale of Used Apparatus Section. Although this was the first time that any attempt had been made to provide for the discussion of this important subject, the interest displayed by those who attended the meeting assures that in the future this subject will be given a prominent place in the convention programs.

The subject is one that is closely allied with electrical contracting and merchandising, inasmuch as it is usually carried on in conjunction with these, yet it differs from them in many respects. For this reason it is surely advisable to hold separate sessions for its discussion. However, there is a question as to the advisability of holding parallel sessions for this purpose for many of the members desire to attend all the sessions as their business comprises all three lines.

While it is true that parallel sessions are held at the conventions of the National Electric Light Association and other organizations and that a considerable saving in time is effected in this way, the conditions are different from those that exist at the contractor-dealers' conventions. At the N. E. L. A. conventions the majority of companies send several representatives each one to cover a certain section. The smaller members of the contractor-dealers' association especially are not in a position to send more than one representative, at present anyway, and this representative is usually the owner. For this reason it is very desirable that the sessions be arranged so that they will not conflict, especially those dealing with merchandising, contracting or repair work. But, in any event the sessions of the latter should continue for they will undoubtedly prove of great value, not only to the members engaged in such work but to the association as a whole.

Test Schedules for Residence Meters

WITH most central-station companies, the residence customer represents the largest number of customers and the ones that bring in individually the smallest revenue. Under these circumstances it is imperative that those costs that are independent of the amount of energy consumed should be kept to a minimum. These charges include the investment in meter and service connections, the cost of maintaining and reading meters, cost of billing, etc.

Routine testing of meters registering the residential consumption is important because, except for the fixed charge often levied to take care of fixed charges upon apparatus, it is the meter reading that determines the revenue from this type of load. The residence load is a comparatively small one, individually, and exists on the average for but relatively short periods each day. Accurate registration is therefore very important. Testing the residence meter, while not costly, perhaps often approaches and sometimes exceeds the revenue derived from a single month, and for this reason it is most advisable to have a maximum lapse of time between routine tests compatible with accuracy of meter operation.

Just what period may be safely allowed between routine tests is a mooted question. Some companies allow 24, some 30 and some 36 months to elapse between tests. The labor situation created by the war necessitated revising meter testing schedules, not from choice but from necessity. Companies are now finding that it may be quite permissible to decrease the frequency of testing from 36 months to some longer period. Sixty months has been proposed. If this can be done quite generally without loss of revenue to the central station or unfairness to the customer, there is a very real gain to the former in that a financial saving accrues as well as other complications.

Elsewhere in these columns will be found an account of what some of the Ohio utilities are doing in the way of making periodic tests of residence meters. Modifications in the test schedules are proposed by which this item of cost can be very materially reduced. This article is worthy of consideration by every central-station company since every such company is dependent upon its metering devices. It is hoped this matter will be taken up alike nationally and that it will be found that much less frequent testing of residence meters is usually permissible.

Electrical Heat Treatment in the Steel Industry

ELECTRICITY in the steel industry. But, then, the steel industry without electricity would be very much like the steel industry without iron. Mention the steel industry and one instinctively thinks of electricity—electricity for driving the rolls and tables, electricity for running the cranes and hoists and supplying the light.

The steel industry is the largest single industrial consumer of electrical energy. Yet as a consumer it may perhaps be said to be only beginning. Most of the electrical energy consumed by the steel industry is used by motor applications of divers sorts. The electric furnace is making headway and each year

sees more and more electric furnaces finding their way into the steel industry, mill and foundry.

But there is another use for electricity that has as yet attracted but little attention except perhaps from those most closely interested. Just as intense heat made electrically is now being used on an ever-increasing scale for melting steel and refining purposes, so too there are those that expect heat made electrically to be employed upon a large scale in the not far-distant future for heating at the lower temperatures, for the soaking pits, for the reheating and annealing furnaces. Electricity so used would represent a very high load-factor and a very considerable consumption of energy.

Mr. Thaddeus F. Baily tells in other columns of this issue what electricity has done in heat treatment in the steel industry during the last year or two. He tells enough to show the vast possibilities of this form of load. He foretells, based upon his experience, the types of furnaces that may be expected to find the widest usage and what they will represent in the way of energy consumption and cost of operation.

It is undoubtedly only a matter of time before soaking pits, reheating and annealing furnaces or ovens come into wide usage because of the better product they make possible and the greater convenience and assurance of uniform product. Meanwhile there is a development stage to be passed through. The possibilities of electricity for these purposes must be made known and those having the greatest faith and the greatest interest at stake must be expected to spread the word. Every engineer connected in any way with the production of steel and electricity should give the above-mentioned article the study it deserves. Electricity for heating at the lower temperatures will not come into the steel industry in a day. Perhaps the day is not yet when it is best that it should come. Meanwhile the more known about this phase of electricity supply the better.

Solving a Threatened Street-Car Strike

WHAT had every indication of becoming a very serious interruption of local transportation in Chicago has been brought into a very satisfactory process of settlement by a simple act of Gov. Frank O. Lowden of Illinois. The organized car and train crews of the surface and elevated electric railways of Chicago presented demands for wage increases averaging some 77%, for reduction of working hours to 8 and for other bettered working conditions. The companies replied that even now they were hard pressed to make ends meet because of high operating costs and it would be utterly impossible to grant the new demands without going into bankruptcy, unless fares were materially raised. At first the city authorities opposed any higher fares. The only body authorized to order increased fares is the Illinois Public Utilities Commission and it showed no desire to take up this matter unless the usual procedure were followed wherein the companies would first have to show that their actual expenses were clearly beyond their income. There was, therefore, every prospect of a continued deadlock coming to a climax by the probable strike of the 14,000 employes involved and very grave interference with all business and social activities through paralysis of the most vital means of urban transportation.

Happily, at this point Governor Lowden stepped in and ordered the Public Utilities Commission to make a comprehensive investigation of the entire situation and act in accordance with its findings. This investigation is now well under way and gives every promise of being impartial, thorough and conclusive. There is a general consensus of opinion that a reasonable increase in wages is due to the men, even if it involves a moderate raise in fares, which is conceded to be an inevitable concomitant. Consequently we look forward to an early and definite settlement of the question that is fair alike to all three parties—the employes, the companies and the public.

On numerous occasions for some five years we have pointed out in these columns that the public service commissions are the bodies most fittingly adapted to consider wage or other labor disputes of the utilities that involve higher operating charges against them. Such questions should and must be considered by the commission that regulates the rates or income. A separate labor board without power to see that its findings can be carried out through abundant income is far from satisfactory, as has been shown by the extremely embarrassing financial position into which so many electric railway companies have been forced due to the wage increases ordered by the War Labor Board last summer. The utility regulating commissions represent not only the utilities and the public but the employes of the utilities as well. Each of these three elements must be fairly considered in utility wage disputes. An outside arbitration board is likely to give inadequate consideration to the public, which in the end must foot the bill.

Even if the public's interests are properly considered, there is likely to be a troublesome time lag before the recommendations of the outside board are acted on by those in authority as to rates, especially in a case like the present.

We hope, therefore, that the present Chicago case will not only be promptly, amicably and equitably settled, but that it will serve as a precedent to utility commissions in other states. This is undoubtedly the most satisfactory method of handling such cases. If legislation is necessary to enable the utility commissions to take up these matters without special request from the state executive, it should be enacted as soon as possible. Meanwhile, Governor Lowden deserves the gratitude of the entire community for having clearly seen a way that is fair to all out of a very threatening difficulty.

Current Events

Important Topics Discussed by Ohio Lighting Men—Plans for Big I. E. S. Convention — Facts on Reconstruction

PUBLIC RELATIONS, SOCIALISM AND TRANSMISSION TOPICS AT CEDAR POINT.

Closing Sessions of Ohio Electric Light Association Deal with Problems of the Hour.

The first two days of the Ohio Electric Light Association's convention at Cedar Point, O., were reported in the July 19 issue of the ELECTRICAL REVIEW. The two last days of the convention, July 17 and 18 were devoted to sessions, addresses and pleasure. On the last day the election of officers for the ensuing year took place. C. H. Howell was elected president, F. H. Golding was elected vice-president, D. L. Gaskill, Greenville, was re-elected secretary-treasurer.

On Thursday two sessions were held. In the morning Freeman T. Eagleson, Columbus, O., presented an address on "The Relation of Utility Companies to Public Service Corporations," in which was discussed the vital problems of today faced by the great public utilities. At this session was presented the report of the Illuminating Committee. This report, presented by F. C. Caldwell, reviewed the work of this committee during the past year. It also made recommendations that the giving of correspondence courses to Association members be continued; that the number of men taking this course be increased and a second series started on the completion of the first; that effort be made to extend the use of the "Technical Letters" course among contractor-dealers, architects and others.

In the afternoon F. G. R. Gordon presented an address on "The Trend of Socialism" before a very large attendance. This was a scathing indictment of the trend of socialism. Mr. Gordon told what socialism has done in Australia, New Zealand and Great Britain. He showed what it was doing in Canada and what it was going to do here unless stopped. He pointed out that municipal control was the thin edge of the wedge, that the attacks upon public utilities and taking them over, was the path of least resistance. It was this path that socialism was following. He brought home to all those present the trend of socialism, its dangers.

At the conclusion of Mr. Gordon's address a water carnival was held on the beach, a number of water sports being indulged in and prizes awarded. A banquet was held in the evening, there being present about 350 persons, after which adjournment was made to the ball room.

The eighth session, held on Friday morning, completed the convention. At this session the reports of the Transmission and Distribution and Finance Committees were presented and officers for the ensuing year elected.

The report of the Transmission and Distribution Committee consisted of a review of the past year's activities, including the papers upon "An Electric Underground Record System" by M. K. Thomen, Massillon Electric Co., "Duct and Manhole Ventilation and Cable Protection" by C. M. Rakestraw, Cleveland Electric Illuminating Co., and "Voltage Regulation of Distributing Feeders as a Means of Improving Central Station Efficiency" by Frank Hershey, General Electric Co., and "Industrial Power Substations" by G. B. Schneeberger, and a statement from the Detroit Edison Co., as to their underground high-voltage distributing system.

A general discussion followed the committee's report on high-tension transmission system design and operation. H. R. Summerhayes, of the General Electric Co., discussed the tendencies in transmission line engineering. He pointed out that much can be done toward development and improvement by closer co-operation between manufacturer and user of apparatus, since the latter is able to find out how equipment behaves in actual practice. Standardization of voltages and high-voltage apparatus was dwelt upon, the benefits being better deliveries, lower cost and interchangeability of bushings and similar details of design. A recent improvement in transformer design by which transformer taps can be changed without having access to the interior of the transformer case was explained, as were also methods of preventing moisture entering the transformer by "breathing." Mr. Summerhayes pointed out the value of the static condenser for power-factor improvement, going on to say that for capacities up to 1000-kv-a. the higher efficiency and absence of attendance, makes the static condenser preferable to the synchronous condenser, on the score of initial cost and efficiency. The influence of power-factor upon voltage regulation, and investment losses was mentioned.

The outdoor substation and outdoor apparatus came in for considerable comment as did also the automatic and semi-automatic substation and power house. According to Mr. Summerhayes, there are about 25 automatic stations in service and some 70 in various stages of completion. For those semi-automatic substations the re-closing circuit breaker was advocated, several methods of obtaining the re-closing feature being described.

W. L. Wallau briefly discussed the possibilities and problems connected with going to the higher potential of 220 kv. He referred to the paper on this subject by Silver before the A. I. E. E. convention, and also to the various reports presented before the recent N. E. L. A. convention. Prof. Caldwell spoke of certain features of re-closing circuit breakers and the control of attendantless substations. R. R. Krammes spoke of oil-break and air-break circuit breakers, drawing remarks from Mr. Summerhayes to the effect that both types of circuit breakers are answering the purpose and that to date it cannot be definitely stated just where the one switch should be replaced by the other. I. L. Kentish-Rankin spoke of the different types of commercial substations, some of

which could be made entirely automatic and some where the higher investment would not be justified. For this latter type of substation the re-closing circuit breaker was particularly well adapted, reducing the time of service interruptions. A method was described by which such substations may often be made to have re-closing features without changing the type of relay, but instead merely making some cheap and simple mechanical changes.

COUNCIL OF NATIONAL DEFENSE ISSUES BOOK ON RECONSTRUCTION.

Reconstruction Research Division Prepares 188-Page Volume Giving Data on Readjustments in 46 Foreign Countries.

The following statement has been issued by Grosvenor B. Clarkson, director of the United States Council of National Defense.

Realizing that American business must, with the signing of peace, be furnished with information concerning foreign reconstruction and readjustment activities, the United States Council of National Defense has prepared for distribution the latest data available.

Through its Reconstruction Research Division, the Council is now transmitting this material in the form of a printed volume of 188 pages to all member organizations of the United States Chamber of Commerce and to all public libraries.

The volume is completely indexed and covers as fully as possible in tabloid form information gathered by the Council. An instance of the scope of the work is in the case of Japanese notes covering not only the reconstruction problem in the Mikado's empire, but also data covering an outline of Japan's development of Chinese shipping, her colonization in Brazil, Japanese monopolization of trade in China, the relations of the empire to the Siberian Railway system, and the China-Japanese secret treaties.

The volume contains information concerning readjustment and reconstruction activities in 46 foreign countries and groups of countries, relating mainly to the governmental activities in the organization and administration of readjustment and reconstruction work.

Compiled from such important official periodical publications of the various governments as were available and from private sources where official information could not be obtained, it covers several hundred different subjects of readjustment and reconstruction activity.

Among these may be mentioned the steps taken in the various countries for the restoration of forests and the revival and increase in agricultural and forestry production; the various treatments that have been accorded discharged soldiers and sailors in the way of bonuses, employment and re-education; the facilities given for their settlement in homes and on farms; investigations made in the various countries where destruction had been wrought, concerning economic conditions; the disposition and utilization of war materials; and steps taken for the changing of factories producing war material to a status of peace production. The systems of finance, banking and credit adopted in the various countries are outlined and the steps taken for the relief of food scarcity and the rehabilitation of the invaded areas are pointed out. The need for and methods used in controlling the distribution of raw materials are outlined, and the plans for the restoration of foreign trade relations and of transportation systems are discussed.

The director of the Council, in announcing the completion of this study, stated that because of the practical impossibility of supplying all business interests throughout the country with separate copies of this digest, it has been considered best to furnish the public libraries of the country with two copies each, and in addition to deliver a copy to each of the member organizations of the United States Chamber of Commerce, as well as to all trade journals—this because of restrictions in the edition due to the necessity of conserving the limited funds available to the Council under its present appropriation.

ILLUMINATING ENGINEERING SOCIETY PLANS BIG CONVENTION AT CHICAGO.

General Convention Committee Developing Numerous Features of Special Interest—Program to Emphasize Applications of Good Lighting.

Plans for the next annual convention of the Illuminating Engineering Society were further developed at the second meeting of the General Convention Committee at the office of Homer E. Niesz, chairman, Edison Building, Chicago, on July 21. The meeting was attended by several officers of the Society, including President-elect S. E. Doane, Past-president George H. Stickney and General-secretary Clarence L. Law. A general consensus of opinion prevailed that the convention, which will be held at the Hotel Sherman, Chicago, on the four days, October 20 to 23, should include numerous features out of the ordinary so as to attract not only a large local attendance but members and visitors from all parts of the country.

At the technical sessions, which will be held Monday afternoon, Tuesday morning, Wednesday morning and afternoon, and Thursday morning, there will probably be less papers of academic interest than formerly and considerably more than usual dealing with commercial application of good lighting. Among these is expected a symposium on the experiences met in different states in applying the state factory lighting codes, which will probably lead to a general discussion bringing out many valuable suggestions for the enactment of such codes in other states. Several papers dealing with factory lighting and equipment therefore are expected. Other papers will present important features of lighting practice in other lines. Military searchlights and use of lighting during the war will be described, if the data on this subject are released by the Government before the time the convention is held.

There is likelihood of one or more joint sessions of the Society with the Illinois State Electric Association and the Illinois Electrical Contractors and Dealers' Association, both of which will hold conventions at the same time. Wm. L. Goodwin will probably address one of these joint meetings, which will be for mutual educational benefit in learning each other's attitude on and method of attacking lighting problems.

Careful consideration is being given to entertainment as well as the business features. Aside from the customary president's reception and subscription banquet, there is planned a special theatre party featuring a dramatization of light and illumination. A special visit to the Chicago Electrical Show is also included, since this will have a large number of very interesting lighting exhibits including a special decorative scheme of illumination for the Coliseum, where the show will be held.

SUMMER COURSE IN FACTORY ORGANIZATION AND SCIENTIFIC MANAGEMENT

Fourth Annual Summer Session at Pennsylvania State College for Two Weeks, August 11 to August 23.

A special course in the above branches will be offered at The Pennsylvania State College on Aug. 11 to 23. No examinations are required for entering the course, but practical industrial experience is desirable. This course is offered particularly for men engaged in industrial activities, as foremen, time keepers, cost accountants, store clerks, members of production or planning departments, superintendents and employment managers. The summer course has been arranged to cover a two weeks' period in order to afford an opportunity to men whose vacation period is restricted to two weeks, to combine a summer outing and recreation with acquisition of practical knowledge in their own field of employment. The instructors are practical men who have had mechanical training, as well as experience in management.

Each morning will be devoted to lectures and discussions on organization, cost accounting and employment management, while the afternoons will be devoted to practical work in the college shops which have been arranged and equipped with a special view to demonstrating and teaching scientific management. The afternoon work will include the making of time and motion studies, the preparation of instruction cards, tool lists, bills of material, route sheets, and scheduling order of work.

The lectures and discussions will be conducted by Maj. Hugo Diemer, professor of industrial engineering at The Pennsylvania State College, whose practical experience includes that of superintendent of the National Motor Vehicle Co., Indianapolis; organization manager for the Goodman Manufacturing Co., Chicago, Ill.; and consulting industrial engineer for many manufacturing corporations, including the Cincinnati Milling Machine Co., Fairbanks-Morse Manufacturing Co., International Harvester Co., and as major of ordnance in charge of important munitions works at the United States Cartridge Co., Lowell, Mass., and the Bethlehem Steel Co.

The afternoon practicum work will be in charge of Lieut. J. O. Keller, who has done time study work at the Aluminum Castings Co., and shop layout work with the Austin Co.

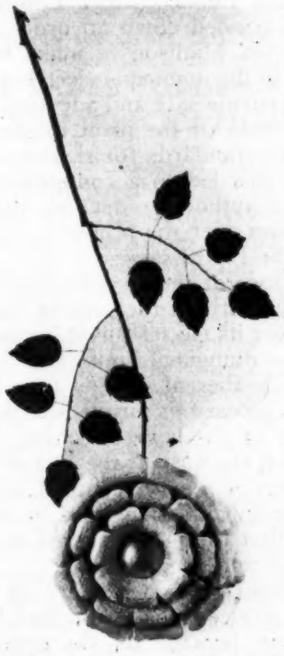
Summer work in the mountain environment of The Pennsylvania State College becomes a pleasure instead of drudgery, providing a summer outing pleasurable, profitable, and economical.

ELECTRICAL DECORATIONS AT PORTLAND ROSE FESTIVAL.

Attractive Illumination of Downtown Streets from Huge Roses with 1000-Watt Lamp Centers.

Electrical decorations were profuse and many of them artistic on the streets and in show windows of Portland, Oregon, during the annual Rose Festival on June 11 to 13. An unique feature of the decorative lighting was the installation on the streets in the business center of 250 Mazda C lamps of 1000 watts each, designed as imitation roses in three colors—deep red, pink and yellow. An illustration of the design, given herewith, shows the frosted lamp bulb as the center of the rose, surrounded by corolla of metal petals, making an imitation rose 30 in. in diameter. The diffusion of the light and the petal coloring were such as to produce to a very good degree the natural tints of the rose. Three such lights were grouped at street intersections and six others were placed between such intersections. Each lamp was hung 30 ft. above the street from the feed wire in such a position as to reflect the blended rays of colored light downward, and to proclaim the glory of the Portland rose to the admiring multitude. The result was a flood of light at night that gave the requisite color effect, and attractive decorations by day.

The 8-foot stem of the imitation rose was the limb of a tree, and the imitation leaves were of tin, so painted as to give the national coloring. The design was that of F. H. Murphy, illuminating engineer of the Portland Railway, Light & Power Co., which furnished the lighting current, and the lamps were installed by the Jagger-Sroufe Co., which carried out the plan of electrical decoration for the Rose Festival Association. The scheme of this kind of decorative lighting was initiated by J. H. Sroufe of that company.



One of the Electrically Illuminated Roses Forming a Feature of Portland's Rose Festival.

LEGISLATURE'S POWER OVER UTILITY RATES REVERTS TO COMMISSION.

The Court of Appeals of New York State has handed down a unanimous decision to the effect that, in cases in which the Legislature had authority to regulate rates, it delegated that authority to the Public Service Commission when it passed the law creating the Commission. The decision was rendered in the case of the International Railway Co., of Buffalo, N. Y., which sought to compel the Public Service Commission to give it a hearing in an endeavor to show that the present five-cent fare is inadequate. The Commission refused the hearing on the ground of lack of jurisdiction. The decision establishes the right of the International Railway Co. to a hearing before the Commission and it is expected such a hearing will be held in the near future.

Commercial Practice

Commission Ruling—Obtaining the Rural Load—N.E.L.A. Christmas Folder—Minneapolis Business—Electric Oven

COMMISSION CITES AUTHORITY TO COMMAND MUNICIPAL UTILITIES.

New Jersey Commission Orders Borough Authorities to Improve Their Electric Plant.

The Board of Public Utility Commissioners of New Jersey has handed down an order directing the borough officials of Madison to make improvements and betterments in the municipal electric plant and system in order to provide safe and adequate service. An inspection was made of the plant to see if operation complied with the standards for service as adopted by the Board, and this led to a contention on the part of the municipal authorities denying the jurisdiction of the Commission over the property. On this point, in its decision, the Board says:

"The observance of the recommendations is resisted by the municipality on the ground that this Board has no power over its electric plant because it confines its service to the municipal limits and does not serve consumers outside thereof. They fear the encroachment of powers reposed exclusively in them.

"The section of the law conferring the authority, however, makes it the duty of the Board to see that its standards of service are maintained alike by public utilities and municipalities engaged in operating public utilities, so that the public served may be insured of safe, adequate and proper service.

"With its experience in matters of standards of equipment and service to be maintained to thus insure safe service, and because of the expertness of its engineers in such matters, both privately and publicly owned utilities rather welcome than resent the inspection of plants, so as to receive the suggestions and recommendations of the Board and its engineers to improve their service.

"We assume the municipal authorities are disposed to furnish the inhabitants of the borough the best service reasonably possible. To do this it is necessary that the things required to be done and recommended in the inspector's report should be complied with."

HOW WE GET THE RURAL LOAD.

Interesting Instance of Power Purchased and Re-sold.

By H. C. Stair,

President, Cambridge (Wis.) Light & Power Co

The last two years have been very prosperous ones for the farmers, especially through the Middle West. Money is plentiful and the growing familiarity with power apparatus, through the general use of tractors and gasoline engines, has created a demand for more power. The gasoline engine has, so to speak, whetted the farmers' appetite for more; it has shown him what the possibilities are and at the same time its limitations and the bother it gives him have made him a live prospect for the convenient and reliable power of the electric line.

Our experience in the central-station business has presented many problems whose solution, I believe, will be of interest to others who have a farming country in their territory. We got into the game in August, 1912, through requests of neighbors that we supply them current from the 110-volt direct-current generator which we had set up in our garage and which was driven by a general-utility gasoline engine. Little by little the business grew and we installed a larger generator and engine in connection with the town's water pumping plant. However, the economical area was restricted to a few blocks and the gasoline engines were costly for fuel and maintenance. Eventually, one of our salesman friends, Harry Caird of Julius Andrae & Sons Co., showed us the possibilities in retailing alternating current purchased from a generating company.

The proposition as we finally worked it out was to build a transmission line 14 miles long from the Edgerton substation of the Janesville (Wis.) Light & Power Co. We purchased the line material, including poles, and secured an experienced construction foreman and crew through Mr. Caird. The work was done during the summer of 1918 and power was turned on Oct. 27, 1918. Along the line we serve a large number of farmers, each of whom pays for his own transformer and protective apparatus. These are all of Westinghouse make and range from 1 to 5 kv-a. The farm load, in addition to lights in house, buildings and yard generally, includes a water pump automatically controlled delivering into a pressure tank for house use, a feed grinder and a washing machine. In some cases a single 3-hp. motor drives a line shaft to which are belted a pump washing machine, churn and separator. Farmers are good customers for appliances and practically every home has an electric iron, tableware and vacuum cleaner.

Our transmission line is 6600 volts, three-phase, and wherever a large block is to be tapped off, we have installed two transformers in open-delta. In the little village of Albion we have two 20-kv-a., 6600 to 220/110 volts, which supply a 15-hp. motor in a creamery and a 30-hp. motor in a grist mill. This mill contains a corn sheller, corn crusher and attrition feed mill, formerly driven by a gasoline engine. We placed an additional pulley on the main shaft and set the motor alongside the engine, thus making the change without rearranging the drive. (In another mill, the owner installed a Sprout-Waldron mill which is driven by two 15-hp. motors mounted on a common bed-plate.) In Albion we serve about 25 domestic consumers, running a wire from the mid-point of one transformer secondary to give 110 volts.

In Cambridge, a town of about 1000 population, we have two 25-kv-a. transformers serving about 130 lighting consumers, as well as a grist mill, a creamery, a garage and the pumping plant. In the creamery

we have a 7½-hp. motor driving a separator, churn, deep-well pump and cream pump. It displaces a steam engine and the owner says that even though he must keep his boiler in service for sterilizing and water-heating, he finds the motor a paying investment in convenience. In the garage is a 5-hp. motor driving various machines, and in the pumping plant is a 10-hp. motor supplying water to the town.

So far we have shut down two low-voltage gasoline-electric sets and in the near future expect to shut down five more. We consider these plants as "trail breakers" for central-station service; they are not powerful enough for the heavier farm service and when central-station power is available, the private plant is out of the running.

Our policy has been to consider the entire project as a money-making proposition. However, as we have secured most of our funds from our consumers, they share in our profits. Farmers are required to pay all costs of connecting to our main line, and we have three short branch lines for which the men served dug the pole holes and paid for all the material.

We do not maintain a "trouble man" but when necessary secure linemen from Janesville. My supervision, bookkeeping, etc., takes about one-fifth of my time. The electric company does not sell appliances or do wiring, but I devote part of my time to the Cambridge Electric Co., which renders these services.

We buy about 8500 kw-hr. per month at the regular wholesale rates and sell it on a four-step graduated scale for domestic use.

POSSIBILITIES FOR ADDITIONAL OUTLET BUSINESS SHOWN.

That certain, definite concerted steps must be taken to provide the necessary outlets for the full utilization of electrical energy is the view of F. H. Scheel, of the Public Service Co. of Northern Illinois, who points out that in analyzing ways and means of promoting this purpose, we find the field naturally divides itself into three separate and distinct units:

"(1) The new home proposed or under process of construction.

"(2) The house already wired, but not equipped with appliance outlets.

"(3) The old residence not yet wired.

"Taking them as they are listed, the first calls for some missionary educational work by the central station among those who have to do with new buildings, such as the architect, general contractor and electrical contractor; also more attention to the wiring specifications of new buildings on the part of the central station commercial department.

"The instalaltion of added outlets in premises of existing customers can be materially increased.

"(a) By combining the offer of outlet and the appliance, particularly in the case of vacuum cleaners, washers, ironing machines and portable lamps.

"(b) By carrying this class of wiring on deferred payments the same as on wiring jobs.

"(c) The use of duplex receptacle, thus permitting two attachments at the cost of one outlet.

"(d) By promoting the sale of electrically wired tea tables.

"(e) By paying salesmen commission on this business as well as on new contracts.

"In the old residence not yet wired, the matter is entirely in the hands of the central station and the electrical contractors. The numerous advantages and comforts of electrical appliances have been a big talking point in getting the prospect to wire. There is, therefore, no logical reason for insufficient appliance outlets. Central stations should—

"(1) Line up the contractor on equipping a home for electric service as well as electric lights. It means more wiring for him.

"(2) Govern the amount of salesman's commission partly by the number of appliance outlets.

"(3) Where price prohibits extra outlets, as in bedrooms, use wall brackets with socket in canopy, thus using same outlet.

"(4) If one or two outlets are given as a premium on special housewiring campaign, make it the appliance outlet.

"(5) Keep a comparative record of outlets secured by each salesman.

"In a few words—think it—talk it—practice it—tie up the idea with our general advertising by some catch word slogan. For want of a better one, I suggest 'More Sockets for More Service.'"

CHRISTMAS SALES FOLDER NOW READY FOR PUBLICATION.

Sample copies of "Electrical Gifts," a Christmas advertising folder prepared by the Commercial Section of the National Electric Light Association are now being distributed. This folder, which features electrical goods as Christmas gifts and briefly describes the many advantages which they offer for this purpose, is attractively printed in four colors and should be of great assistance in creating a big demand for electrical gifts. Many of the more common electrical appliances are illustrated and described with alluring captions. Space is provided on the back of the folder for imprinting the name and address of the company that distributes them.

A very large edition of this business-getting folder will be printed shortly, so that shipments can be made well in advance of the Christmas season. In this connection companies desiring copies are especially urged to order them now, for the imprinting, if done when the folder is on the press, enables the association to quote lower prices. These prices range from $4 per 100 in small lots to $16.50 per 1,000 in quantities of 50,000 and over.

Orders received after edition is printed, necessitating additional labor and expense, will be filled, if possible, but at increased prices. The advisability of estimating the requirements and ordering now is therefore evident.

Requests should be made to the Publications Committee. Commercial Section, 29 West 39th street, New York City.

ELECTRIC OVENS COUNTERACT SERVANT SHORTAGE.

At the manufacturers' exhibit of the Ohio Electric Light Convention, Cedar Point, O., July 15 to 18 inclusive, Miss Sigourney J. Frush, demonstrator for the Westinghouse Electric & Mfg. Co., baked pies and cakes and candy with a Westinghouse oven.

Miss Frush backed her statements with deeds, keeping an interested gathering around her as she explained the automatic features of the electric range, how it became a "fireless cooker" and how simple it was. Miss Frush said the servant problem would be less serious and less often discussed, if people only realized the cleanliness and convenience of the electric range.

Operating Practice

Testing and Setting of Relays — Complex System Trouble Due to Generator Breakdown — Protecting Rubber Gloves

PRECAUTIONS TO BE FOLLOWED IN TESTING AND SETTING RELAYS.

Application of Test Current and Method of Timing Important Factors in Testing.

Costly and ideal systems of relay protection are of little value unless the relays installed are properly tested and checked with sufficient frequency and accuracy to assure that they are in proper working conditions. In this connection pertinent advice was given in the paper on "Transmission-Line Relay Protection," presented before the A. I. E. E. convention recently. A large part of this paper was abstracted in the issue of July 5.

In order to secure the best results from the relays, it is desirable to make a complete check on the current and time settings of each relay on the first installation and at least once every six months thereafter. Although the time for making these tests is determined to a large extent by the operating conditions, best results

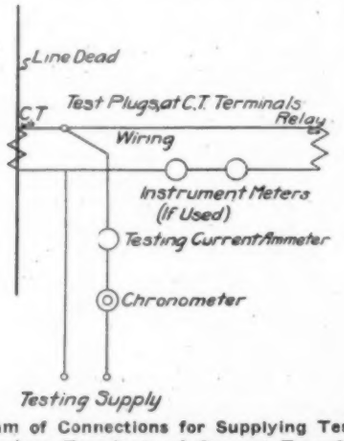


Fig. 1.—Diagram of Connections for Supplying Testing Current to Secondary Terminals of Current Transformer.

will be obtained if a general plan is worked out for performing these tests at regular intervals.

If selective operation is to be obtained from the relays the greatest care and precautions must be taken in making these tests. The tests should be performed under conditions as nearly equal to the operating conditions as possible which makes it desirable to include the wiring and complete relay equipment in this test.

In this test, the test current should be applied, wherever practicable, to the primary of the current transformer. Where it is impracticable to do this the testing current may be supplied to the secondary terminals of the current transformer with the current transformer left in circuit as a shunt, as shown in accompanying wiring diagram. The results obtained under these conditions very closely approximate those under short circuit and serve to check the relay wiring and current transformer, as well as the relay. This will detect any short circuit in the current transformer or wiring and any open circuit in the wiring but open circuits in the transformer coils should be determined by a separate continuity test.

The degree of accuracy obtained when the relay is tested alone is dependent upon the type of transformer used and the secondary load. The error in this method is due to the high magnetizing current of transformers (especially with the low-ratio single-turn type on heavy secondary loading) on the heavy short-circuit conditions. As an example, a 40-volt-ampere secondary load on a current transformer at full load imposes a 16-kv-a. load under short-circuit conditions of 20 times full load. This, in many cases, is above the saturating point of the transformer and the ratio breaks down badly.

The time-current curve of a relay is affected by the nature of the secondary load or by the characteristics of the current transformer. It is, therefore, desirable that each individual relay be tested with current such as would be occasioned by short circuit. At least three points along the curve should be taken, one of which should be approximately 150% of the minimum value, one at as near maximum short-circuit current as the testing equipment will permit, and one intermediate point. The time should be taken by a chronometer or cycle counter which will eliminate the personal equation of the operator. The method of timing by a stop watch is entirely inadequate for close relay settings.

An additional inspection should be made about every month for continuity of trip circuits (where this is not indicated by lamps) and for dirt or mechanical defects. Moreover, where conditions will permit, the relay should be operated to trip the circuit-breaker. In case of bellows relays the bellows should be oiled with neatsfoot oil to prevent hardening.

ACCIDENT TO TURBOGENERATOR CAUSES MANY TROUBLES.

Hunting of Systems and Exciter Troubles Follow Breakdown of Field and Armature.

On a big central-station system there were six 10,000-kw. turbogenerators on one sectionalized bus operating in parallel with three 10,000-kw. and one 25,000-kw. turbogenerator on another section of bus, these two bus sections carrying about 45 and 55% of their rating, respectively. At another station, tied into the above station over tie-lines, were four more turbogenerators carrying about 60% of their rated load. At a third station three large units, of 20,000 kw. and above, were operating at about 70% rating. This station was tied in with the other two stations over tie-lines.

One of the field end-plates of one of the 10,000-kw. vertical type generators became detached and fell in between the field and armature. This resulted in the coils of both field and armature being cut, causing a

short-circuit on the 9000-volt windings and the exciter side of the machine. The defective machine was cleared from the system almost immediately.

Directly following the burn-out of the unit and the disturbance created, several of the turbogenerators in the same station tripped out due to overspeed; a number of synchronous converters in various substations on the system shut down. One rotary burnt up. The system began to hunt and persisted for about 18 minutes after the turbogenerator broke down, the frequency varying considerably above and slightly below normal, and the voltage going from 7000 to 8800 volts in heavy swings. The wattmeters on the tie-lines between the three generating stations swung continuously from one end of their scales to the other, indicating heavy interchange of current between stations.

After this had continued for about 18 minutes conditions suddenly quieted down, although for no apparent reason, and the system pressure rose to 9400 volts, about normal.

It was then found that the reactances in the tie-lines between stations have been so hot as to oxidize at the surface of the cables (they were of the bare cable, concrete core type), and the insulating compound on the frame work was blistered. Tie-line ammeters and wattmeters on one end of a tie-line were badly damaged.

It was later discovered that one tie-line solenoid-operated circuit-breaker and one high-voltage feeder circuit-breaker were in the half-open position, the solenoid of this latter being burned open and grounded. It then became known that the negative return from the oil circuit-breaker of one of the 10,000-kw. turbogenerators has grounded and burnt open, and that a dead earth has occurred on the exciter system.

One explanation of the cause of the 18-minute surge or hunting between the three generating stations is that the breakdown of the defective turbogenerator had resulted in a phase displacement between the three systems. As these systems were tied-in together through tie-lines, the reactance prevented sufficient synchronizing current to flow between systems to bring the systems into phase again. And the disturbance continued until the abnormal conditions subsided and the system attained its equilibrium again. Whether it was excess resistance or too much or too little reactance might be a mooted question without investigation, of course.

The trouble to the exciter system was doubtless due to the exciter system being subjected to high potential to ground, it causing breakdown at several places, and possible weakened insulation at others. Contact between armature and field when the field end-plate cut into the coils caused direct contact between the 9000-volt system and the exciter system, of course, and a consequent breakdown in the immediate vicinity.

While only a few of the salient features of the trouble have come to hand, and these are not complete, sufficient is known to bring out the facts that hunting between systems is not yet a matter that can be fully explained nor guarded against under unexpected conditions. Moreover, the above incident shows that exciter systems may be subjected to direct contact as well as to induced high potentials, hence it might be well to give exciter systems the respect given to circuits of higher potential, and perhaps at the same time furnish a means at individual generators to prevent high potentials dissipating themselves promiscuously throughout the exciter system.

PROMOTING USEFULNESS AND SAFETY OF LINEMEN'S RUBBER GLOVES.

Container Hung from Belt Is Advocated.

Rubber gloves are now furnished by most central station and electric power companies to their linemen. Safety first rules dictate that they be used whenever work is being done on voltages above 600 volts. Although wooden poles have an insulating value, the wood is not to be depended upon and rubber gloves are considered as absolutely necessary for the lineman.

As a matter of fact, while most companies and municipalities furnish rubber gloves to their men free, these gloves are not always used. Frequently in cases of electrocution it is brought out that the man killed did not use his gloves or did something else that he ought to have known he should not do.

One reason that rubber gloves, although available, are not used, is because they are not always conveniently at hand. Some linemen tuck their rubber gloves in their trouser pocket while climbing the pole and fixing their belt. Others tuck them between their belt and body. One of the chief reasons linemen tend to not use their rubber gloves is because they usually have no convenient place to keep them unless on their hands, and they should be worn only when actually needed because otherwise they may be punctured by splinters on poles, nails and similar sharp projections. Moreover, rubber gloves enclose the hands and keep out air which results in sweating, which in turn rots the rubber and causes personal discomfort.

A policy that has much to recommend it is that of furnishing weatherproof canvas bags of such a size that the rubber gloves may be slipped into them without folding or crumpling up, either of which tends to cause cracks in the rubber. These bags should have a loop or two loops so located that the bag may be hung from the lineman's belt. The top should have a flap that comes down well over the opening of the bag so that rains will not enter the bag and the lineman can easily close the bag by merely pressing the flap against the side.

If companies would furnish their linemen with these bags when they allot the gloves there would be less tendency on the part of the men to work without their gloves on their hands, since the gloves would always be available at a convenient place, like all the other tools in the lineman's belt. The gloves would be less likely to be damaged due to mechanical injury, one glove of a pair would be less likely to be lost. The gloves would have a longer useful life and the element of danger would be less.

AIR-COOLED BRICKWORK REDUCES CLINKER TROUBLES.

By designing the furnace setting for circulation of air from beneath the fuel bed through the brickwork into the furnace, there is less need to chisel frozen clinker from the walls; coke is burned off the clinker, thereby reducing loss of carbon; heat units lost by radiation through the side walls are largely recovered again; and considerably less labor, time and expense are required to keep furnaces in good condition. Furnaces are able to maintain rates of combusion and remain in service longer without shutdown and the life of the brickwork of furnace walls is greatly increased.

Contracting-Construction

Some of the Methods Employed in the Conduct of a Successful Electrical Machinery Repair Business Explained

WHAT CONSTITUTES EFFICIENCY IN REPAIR BUSINESS.

Paper Presented at Recent Convention of National Association of Electrical Contractors and Dealers.

By A. Penn Denton,

Denton Engineering & Construction Co., Kansas City, Mo.

In the development of the contractor-dealer's business during the period of reorganization and readjustment since October, 1917, when Wm. L. Goodwin

CUSTOMER'S WORK ORDER

DENTON ENGINEERING & CONSTRUCTION COMPANY

Date _____ Job No. _____ Repair Shop Order No. _____

Name _____

Work Address _____ Bill Address _____

Ordered By _____

Customer's Description of Work _____

Date Promised _____

Date Finished _____

Actual Work Done _____

Permit _____ Inspection Date _____

Shipping Instructions _____ Weight _____

Remarks _____

Order Received _____ Time Received _____

Order Acknowledged _____

Workman _____ Superintendent's O. K. _____

Customer's Work Order Form Used by Denton Engineering & Construction Co.

pointed the way to larger fields of endeavor and greater possibilities for them, there has come to many contractors a realization of the opportunities to be had in the sale of used and rebuilt electrical machinery and in the repairs of such equipment. It is not the intention to discuss the business of selling used machinery which has been found profitable, but to give briefly the result of the experience of the author's company in repairing and rebuilding electrical equipment and to point out how important efficiency is in this line of work.

The repair shop of the contractor a very short time ago was not much more than a corner of the stockroom. In some cases he had a small room set aside for this work but the one or two men employed at that time did not appear to him of sufficient importance to provide these men with either the proper place or equipment so that they could make a showing that was at all comparable with the wiring and construction department. This company passed through this stage of development and then began to realize that by giving its machinery repair department just a small part of the attention the construction department was receiving, in a short time it began to show real results and looked like a paying proposition. It then turned its attention to the department with the idea that it should become as important a factor on the total business as the construction department. The plan followed started with a careful study of the best way to get the machinery repair business and the proper way to handle it after it was secured.

It was found that three important factors were essential in going after repair business. It was necessary to: First, advertise in the local newspaper and the trade papers. The repair business is entirely different from contracting or merchandising in that the average consumer who needs such service has no idea of where he can go to get a good job of repair work done, and in the case of the large industrial plant usually has done its own repair work or sent it to the repair shop of the manufacturer of its particular electrical equipment. It found also that an excellent advertising medium was a series of letters sent to the customers, enclosing advertising blotters. The third and most important fact in the now to get the business plan was found to be a good live salesman who was sent out to sell what was termed as electrical repair service and it was found by carefully following up the advertising that the company was able to get business

Denton Engr. and Const. Co.

SHOP IDENTIFICATION TAG

Customer _____

_____

_____

Description of Work _____

_____

_____

Job. No. _____ SO # _____

Time Rec'd _____

Time Finishes _____

Front and Back of Tag Attached to Machines, Which Facilitates Identification.

from companies who formerly had said they were not in the least interested. A salesman of this service need not call oftener than once a month on the larger plants and once in 60 days on the small plants. By persistently following this plan any dealer can get a share of the repair business in his community.

When the business is secured, the next part of the scheme is to be able to handle it properly and efficiently. It is even necessary in some cases to give better service, certainly a prompter service than the manufacturers' repair shop, if the business of the plant or customer who has felt he was fairly well taken care of before you sold him, is to be held. It is therefore of primary importance to have a good organization. A manager of the repair department is required, someone who can be held entirely responsible for the proper handling of the work, and this party may be at the same time a salesman. The Denton company has found the duties of the manager and salesman combined nicely and worked out much the same as in its construction department where the department manager is responsible for getting all business and supervising the work after it is secured. It is also necessary to have a service man who can assist with the purchasing of the repair department materials. Then, most important in the repair shop organization is the foreman of the shop, who must be a man of practical and technical experience, a good executive in handling men and a person who is willing to co-operate with other employes.

It is also necessary to have a good stockman and a careful accounting and billing department. Promptness and accuracy in sending invoices makes the repair business a pleasure because a large part of the work is labor and all repair business should be handled on a strictly cash basis. In this connection it was found that a most important adjunct to the organization was proper forms for making records of each job handled. Some of the forms developed are illustrated herewith.

The importance of such an organization is in a measure secondary to the proper equipment of the shop. It has been found that the right kind of equipment such as coil winding and taping machines, a baking oven, coil dipping tanks, etc., are an absolute necessity in a shop that expects to be any factor at all in the repair business because without such equipment the work cannot be efficiently handled and if not efficiently handled it is not profitable. It is therefore necessary to invest a considerable sum of money in the proper kind of equipment and for this reason no contractor should undertake to go into the repair business who has not sufficient capital.

No._____

REPAIR SHOP ORDER

DENTON ENGINEERING & CONSTRUCTION CO.

Date Job No.

Name

Address

Work Done At

Description of Work

MACHINE DATA

Manufacturer

Name Plate No.

Type Form

Speed Cycles Phase

H. P. Volts

Current Amps.

Connection Print No.

No. Coils

Turns per Coil

Throw of Coil

Weight per Coil

Size Wire

Adjacent Coil Series

Alternate Coil Series

One Circuit Winding

Two Circuit Winding

Connections Δ or Y

Quantity	MATERIAL ITEMS

Job Ticket for Keeping Record of Repair Jobs.—Front.

DESCRIPTION OF WORK						
Dismantling and Cleaning	Date	S. M.	Hrs.	Date	S. M.	Hrs.
Making Coils						
Installing Coils						
Bearings						
Commutator						
Miscellaneous						
Finish						
	Total					
	Cost		Bill			

Reverse Side of Job Ticket.

New Appliances

Intermediate Size Dungar Battery Charge Set—Small D. C. Instruments—Auto Lighting System—Entrance Switch

The New "Four-Battery" Tungar Rectifier.

The General Electric Co., Schenectady, N. Y., has just placed on the market a new "Four-Battery" Tungar battery charger, designed to meet the needs of the automobile dealer or garage owner, who desires to do a small amount of battery charging.

As its name indicates, this new size is an intermediate between the big 10-battery Tungar outfit for service stations and the small Tungar for home use.

The "Four-Battery" Tungar will charge from one to four three-cell batteries at a maximum of 5 amperes. The rate can be varied from 3 to 5 amperes. It operates from a standard 115-volt, 60-cycle alternating-current circuit.

The essential parts are a bulb for rectifying the current and a transformer for reducing the voltage, both of which are contained in an attractive sheet-

Tungar "Four-Battery" Charging Rectifier and Controller.

metal case. An ammeter, for reading the charging current, and a dial switch are mounted on the front of the case.

The device is very easily installed. Simply mount it on the wall with four screws and connect the leads to the alternating-current supply. The operation is very simple. Connect the direct-current leads to the batteries. Turn the dial switch to the right until the ammeter reads the desired charging current. To stop charging, turn the switch back.

There are no moving parts in the Tungar set, and it requires no oil or grease. It has been approved by the fire underwriters, and can be safely operated over night without attention. If the alternating-current supply fails, the batteries cannot discharge back through the rectifier. When the current comes on again, the Tungar will commence charging automatically at the same rate as before.

Automobile Lighting With a Single Lamp.

Ira T. Swartz, president of the Swartz Electric Co., Indianapolis, Ind., has developed a new method of automobile lighting, to be known as the "wireless-lite." Although the conventional number of head lamps, side, dash and tail lamps are provided, only one electric incandescent lamp is used in the entire system. This feature gives the new system its name, as all exposed wiring is eliminated. A lamp of high candle-power is employed as the source of illumination. The light from this single lamp is, by a clever arrangement of mirrors and lenses, distributed to the various points. Various adjustments of the light can be made by the driver from a control lever on the dashboard. The system is said to be very efficient and economical.

Pocket-Size, Portable Direct-Current Instruments.

The Roller-Smith Co., 233 Broadway, New York City, announces a new design of its small, pocket type, direct-current "Handy" ammeters, voltmeters and volt-ammeters. This instrument was in the course of development for many months, during which time there was constant experimental work to determine the best design and materials suitable for an instrument of this class. The result is one of which the company is justly proud. The new "Handy" instrument is small, compact and light. It was designed with the idea constantly in mind that accuracy and reliability must be maintained even under the most severe conditions.

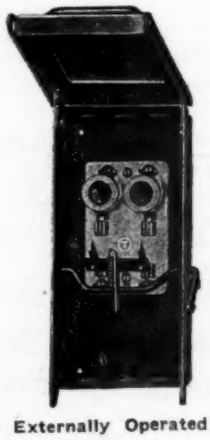
This line is very complete, comprising milliammeters and ammeters up to 50 amperes; millivoltmeters and voltmeters up to 150 volts and volt-ammeters up to 50 amperes and 150 volts, all self-contained. The ranges are increased beyond that by the use of appropriate shunts and multipliers. These instruments are of the permanent-magnet, moving-coil type giving uniformly spaced scale divisions and dead-beat or instantaneous indications. There are two magnets that are well aged and made of high-grade tungsten steel. A very rigid but light-weight moving coil is used. It swings on hardened steel pivots in sapphire jewel bearings. The staff of the moving system is stiff and not likely to bend and cause friction. A rigid aluminum pointer of the knife-blade type is used. The scale is 2¾-in. long and usually divided into 50, 60 or 75 divisions. All instruments are individually calibrated and guaranteed accurate within 1% of full scale value.

A brass case encloses the instrument's mechanism and scale; it receives a black rubberoid finish. The instrument dimensions are 4 in. wide by 5 in. high, by 2 in. deep. On the average instrument the weight is about 20 ounces. Instruments are available in this line with double or even triple ranges of scale markings at slight additional price. In the case of volt-ammeters it is possible to obtain instruments having even three volt and three ampere ranges.

These instruments are well adapted for general commercial testing of various kinds as well as for school and college laboratories where a small and quite accurate, but moderate-priced instrument is desired.

Enclosed Service-Entrance Switch.

Service switches must be installed at a point as close as possible to where the service entrance is made to the building. They must be of reliable type so as to permit quickly cutting off of all



Trumbull Externally Operated Entrance Switch.

current from the building in time of emergency or when extensive repairs are necessary to the interior wiring. They should also be properly safeguarded to protect the occupants of the building from coming into contact with exposed conducting parts. This necessitates a suitably enclosed switch that can be externally operated without opening the enclosure.

These various requirements are incorporated in the externally operated service switches illustrated herewith. They are made by the Trumbull Electric Manufacturing Co., Plainville, Conn., and consist of its regular switch No. 701 in a No. 16 gauge steel box. It is known as No. 5741 and is rated 30 amperes, 125 volts and is made for plug fuses. The switch is of the quick-break type and a marked improvement over the ordinary service switch from the safety standpoint.

Trade Activities

Okonite Holds Annual Outing—Wheeler Condenser & Engineering Elect Officers — Electric Furnace Installation

Electric Furnace Installation in Navy Yard.—An interesting development recently took place at the League Island Navy Yard, Philadelphia, when the first heat of steel was made in the Greaves-Etchells furnace recently installed by the Electric Furnace Construction Co.. Finance building, Philadelphia, in the new foundry. The foundry itself is said to be one of the most modern and up-to-date in the country, and the manufacture of steel in this yard opens up very interesting possibilities for large future development.

Philip H. Ward, Jr., formerly general manager and secretary in charge of sales and exports of the Chelten Electric Co., announces that he has severed his connections with that company and has organized the Ward Electric Co., Inc., Philadelphia, with headquarters in the Philadelphia Stock Exchange building. The new corporation will manufacture for domestic and foreign distribution, an extensive line of electrical supplies and specialties, including knife, push button and surface snap switches, flush receptacles, new code and plug fuses, porcelains, ground clamps. It will be the aim of the new organization to furnish to the trade products of superior merit, promptly, at attractive prices.

Dayton-Dowd Co., Quincy, Ill., manufacturer of centrifugal pumps, is distributing Bulletin No. 240, illustrative and descriptive of its redesigned line of type CS single-stage, double-suction type centrifugal pumps. These pumps embody the most advanced principles of design and represent among the most modern, high-grade, standardized, highly efficient machines on the market. They are simple in design and rugged in construction, insuring reliability in service and durability. The bulletin contains several curves made from data resulting from shop tests showing the characteristics of several sizes of Dayton-Dowd pumps; also a table giving the capacity, speed and efficiency of the type CS single-stage double-suction pumps.

The Belden Manufacturing Co., 2300 South Western avenue, Chicago, Ill., has recently let contracts for the erection of a new four-story factory building at its new plant location at Kilpatrick avenue and West Congress street, Chicago. This will make the third building erected by the company on this tract of land. The erection of five more buildings is contemplated in the next few years. The new building will be used for expansion of the different magnet wire departments.

The B. & K. Manufacturing Co., New Britain, Conn., manufacturer of pole line hardware and pressed steel construction specialties, announces the appointment of David C. Rosetahl, formerly affiliated with the National X-Ray Reflector Co., as general sales manager of its portable lamp department. The company has adopted a new plan for merchandising its product throughout the country with the idea of expanding its organization in every large city in the United States and Canada and with this end in view has engaged Mr. Rosetahl as its general sales manager. For the past six months the designing department of this organization has been very active in making up illustrations of novelty portable lamps and it is today one of the representative manufacturers of this line of electrical equipment.

The Okonite Co., Passaic, N. J., well known manufacturer of insulated wires and cables, has inaugurated the custom of giving an annual outing to its office and factory staff. This year the gathering took the form of an old-fashioned Rhode Island clambake and was held at College Point, Long Island, with an attendance of 65. The group picture presented herewith shows President H. Durant Cheever near the center of the first row of chairs and ex-President Willard L. Candee, one of the founders of the company, seated at the right of the same row. General Sales Manager J. D. Underhill and Treasurer W. H. Hodgins are to be seen standing at the left of the last row.

Wheeler Condenser & Engineering Elects Officers.—At a meeting of the board of directors of the Wheeler Condenser & Engineering Co., Carteret, N. J., on July 8, J. J. Brown, formerly vice-president and general manager, was elected president, succeeding Charles W. Wheeler, recently deceased. H. S. Brown, of 50 Congress street, Boston, was elected vice-president. H. S. Brown has been associated with the Power Specialty Co., 111 Broadway, New York City, for the past 15 years, the greater part of the time as New England manager for that company. During the war he was active with its government work with headquarters at Washington and Philadelphia. He is also president of the Brown-Ferries Co. of Philadelphia. The business of the Wheeler Condenser & Engineering Co. has more than quadrupled during the past ten years under the management of J. J. Brown, and the manufacturing capacity of the plant has been correspondingly increased. One important addition has been the construction of a large tube mill for the manufacture of seamless drawn tubing of brass, copper and special mixture. In this mill the record output of nearly one million pounds of condenser tubing in one month was recently made. This tubing is used not only in Wheeler condensers, evaporators, reboilers etc., but it is also made in large quantities to customer's specifications for American trade and for exporting. At this writing, in the condenser department, 16 condensers of approximately 50,000 sq. ft. cooling surface are being made. Among other products of this well known company are: natural and forced draft cooling towers; centrifugal pumps; vacuum pumps — patented steam jet, turbo dry rotative and Wheeler-Edwards; jet condensers; heaters; exhaust relief valves; vacuum pans, and single and multiple effect evaporators.

Office and Factory Staff of the Okonite Co. at Annual Outing.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Bar Mills, Me.—Bar Mills Power Co. is having plans prepared for extensions and improvements in its hydroelectric power plant, including considerable remodeling work.

Boston, Mass.—Nelson Corp. will build a one-story, 400x500 ft. manufacturing plant, a two-story, 80x400 ft. receiving building, a four-story, 60x120 ft. office building and a two-story, 84x87 ft. power house.

Boston, Mass.—Nova Scotia Tramways & Power Co., Halifax, Nova Scotia, has arranged for a note issue of $1,000,000, the proceeds to be used, in part, for extensions and betterments in its plant and system. The work will include addition to boiler plant for increased capacity, extensions to gas plant and system; new rolling stock, and other equipment. The company, managed by the Stone & Webster Corp., Boston, operates the electric light and power, and other public utility properties at Halifax, Dartmouth, etc.

Brockton, Mass.—George E. Keith Co., has commenced the construction of the proposed one-story power plant at its local shoe manufacturing works, to be used for factory operation. The structure will be 60x70 ft., and will be connected with the factory by means of an underground tunnel. The structure with equipment will cost about $100,000.

Quincy, Mass.—Fire recently damaged the plant of the Quincy Electric Light & Power Co. The loss is estimated at $15,000.

Whitman, Mass.—Edison Electric Illuminating Co. of Brockton has disposed of its former power plant building at East Whitman to the National Foundry Co. The structure was erected about 30 years ago by the Whitman Electric Light & Power Co., and was employed for furnishing service in this district. About fifteen years ago the plant was purchased by the Edison company; following arrangements for taking power from Brockton and later, from East Bridgewater, the plant was closed down and has not been operating for some time past.

Hartford, Conn.—Arrow Electric Co. will erect a two-story addition to its factory to cost $45,000.

Hartford, Conn.—Twin State Gas & Electric Co. has arranged for an increase in its capital to provide for additional operating funds, as well as proposed extensions and betterments.

New Haven, Conn.—Yale Tire & Rubber Co., Highwood, has broken ground for the construction of a one-story power plant at its works, to be provided with a brick or reinforced concrete stack.

Belport, N. Y.—Northern New York Utilities, Inc., contemplate the erection of a high-tension steel tower transmission line from the company's power house to Towville, a distance of 20 miles. The estimated cost of this extension is $200,000. H. G. Davis, Light and Power building, Watertown, is chief engineer.

Binghamton, N. Y.—L. P. Amslie, 41 Laurel street, Johnson City, N. Y., has received the electrical contract for work in a new two-story school building at Hooper, near Binghamton.

Central Islip, N. Y.—Bids have been taken by the State Hospital Commission, E. W. Elwood, secretary, Capitol building, Albany, for the installation of the proposed new boilers, stoker equipment, etc., at the Central Islip State Hospital. Lewis F. Pilcher, Capitol building, Albany, is State Architect.

New York, N. Y.—Henry L. Doherty & Co., 60 Wall street, have announced the establishment of a new branch office in the Morris building, Philadelphia, Pa., to be placed in charge of Ralph Runyan. The company is now operating 14 branches in various cities.

New York, N. Y.—Western Union Telegraph Co. has completed negotiations for the leasing of the entire fifth floor of the building at 395-99 Broadway, located at Walker street, to be used for new executive offices. The lease aggregates $100,000 in rentals.

New York, N. Y.—International Telephone Sales & Engineering Corp., a Delaware incorporation, has filed notice of authorization to operate in New York with a capital of $3,800,000. R. S. Gould, 37 Wall street, is corporate representative.

New York, N. Y.—The Wills Egelhof Co., Inc., 101 Park avenue, has been awarded the general contract for the erection of the Citizens National Bank building located at Covington, Va. Alfred C. Bossom, New York City, is architect.

New York, N .Y.—Wappler Electric Co., Inc., 173 East 87th street, manufacturer of batteries and other electrical equipment, has awarded a contract to the Turner Construction Co., 244 Madison avenue, for the construction of its proposed three-story reinforced concrete manufacturing plant on property recently acquired on Harris avenue, near the Queensboro Bridge, Long Island City. The structure will provide a total manufacturing area of about 50,000 sq. ft. The company recently increased its capital from $750,000 to $850,000.

Ossining, N. Y.—Contract has been awarded to the Van Wagoner Linn Construction Co., 143 East 27th street, New York, by the New York Commission on New Prisons, Hall of Records, New York, for electrical work in connection with the construction of proposed additions to Sing Sing Prison, Ossining. The electrical work is estimated at $16,365.

Potsdam, N. Y.—Final contracts have been awarded by the State authorities for the construction of the proposed boiler plant at the Potsdam Normal School, the H. M. Week Co., New York, being the building contractor. Contract for electrical work has been let to the Hudson Electric Engineering Co., New York.

Troy, N. Y.—In connection with the construction of a large new local armory building now under consideration by the State Armory Commission, a quantity of electrical equipment will be required, the proposed structure being estimated to cost $475,000. Col. Franklin W. Ward, Telephone building, Albany, is secretary of the commission. Lewis F. Pilcher, Capitol building, Albany, is state architect.

Bernardsville, N. J.—Following a severe electrical storm, the lines of the New Jersey Power & Light Co., at Brookside, near Mendham, were thrown out of commission. This is the high-tension system furnishing service at Bernardsville, and the city was in darkness for about 24 hours.

Bloomfield, N. J.—Bloomfield Electric Shop has filed notice of organization to operate at 596 Bloomfield avenue. Leon G. Frank, 1395 Brestow street, New York, heads the company.

Jersey City, N. J.—Modern Gas & Electric Appliance Co., 568 Newark avenue, has filed notice of organization to manufacture electric and gas fixtures. Frank Tury heads the company.

Newark, N. J.—Rainbow Electric Co., 258 Chadwick avenue, has filed notice of organization to manufacture electrical specialties. Samuel Rubinstein is head.

Newark, N. J.—Springfield Light Co. has filed notice of organization to manufacture electric lighting fixtures, with works at 452 Springfield avenue. Harry Shapiro, 115 16th avenue, heads the company.

Newark, N. J.—George J. Crosman, operating a plant at 139 Jackson street for the manufacture of composition specialties, will install a new boiler and engine plant in connection with his works, to be located on Astor street.

Paterson, N. J.—Business interests located on Main street are negotiating with the Public Service Electric Co., for the installation of a new white way street lighting system along the thoroughfare.

Perth Amboy, N. J.—Jersey Central Traction Co. has been ordered by

the Board of Public Utility Commissioners to make improvements and extensions in its plant and system for general betterment in service. The work includes improvements on the Keyport-Perth Amboy Division, the Matawan-Keyport Division, and at Atlantic Highlands.

Plainfield, N. J.—A new company is being organized to be known as the New Jersey Trackless Trolley Co., to construct and operate a trackless trolley line between Plainfield, South Plainfield and Metuchen. The estimated cost of the new system, including overhead lines, poles, etc., is $125,000. Among the first subscribers to the new company are the Spicer Manufacturing Co., Charles H. Frost and Tepper Brothers. The Public Service Railway Co. has refused to extend its lines along this new route, holding that it would cost about $140,000 and the company was not in a financial position to make the investment.

Trenton, N. J.—Trenton Electric & Conduit Co. has filed plans for the erection of two new one-story additions to its works at 1-3 Tyler street, to cost about $10,000.

Trenton, N. J.—A 10-ton electric traveling crane and other electrically operated equipment will be installed in the new one-story machine addition to be erected at the works of the John E. Thropp's Sons Co., Lewis street, manufacturer of tire-making molds and machinery.

Trenton, N. J.—The Board of Public Utility Commissioners has ordered the Trenton & Mercer County Traction Co. to make a number of improvements and additions in its system in different parts of the city.

Trenton, N. J.—The Board of Public Utility Commissioners has granted permission to the Trenton & Mercer County Traction Co. to dispose of property, aggregating about 37½ acres of land in Hamilton Township, to the Pennsylvania & Newark Railroad for a consideration of about $15,000.

Washington, D. C.—The Bureau of Yards and Docks, Navy Department, will build an addition to its electric power plant at Paris Island, S. C., to cost about $10,400.

Bristol, Pa.—The Borough Council and local citizens are negotiating with the Eastern Pennsylvania Gas & Electric Co., for the operation of its auxiliary plant, installed in co-operation with the borough, during non-service periods from other sources of supply. The auxiliary plant was designed to be used in connection with the local street-lighting system, as well as for other service.

Catasauqua, Pa.—An ordinance is being considered by the Common Council providing for a bond issue of $50,000 for the construction and operation of a municipal electric light and power plant.

Easton, Pa.—Pennsylvania Utilities Co. will soon commence the installation of three new boilers at its Dock street plant for increased capacity. The units will have a total capacity of about 2300 hp.

Pittsburgh, Pa.—The Public Service Commission has approved the merger of a number of electric companies operating in Beaver county with the Harmony Electric Co., to be operated as a unit system in the future.

DATES AHEAD.

National Council of Lighting Fixture Manufacturers. Midsummer convention, Cleveland, Ohio, Aug. 5 and 6. Secretary-treasurer, Charles H. Hofrichter, 8410 Lake avenue, Cleveland, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 19-21. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual Convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Pittsburgh, Pa.—Pittsburgh Model Engine Co. has commenced the erection of a plant on Lexington avenue, near McPherson street, to cost about $200,000. The works will comprise a one and two-story building, 40x180 ft., and 60x320 ft., respectively.

Pittsburgh, Pa.—Considerable electrical equipment and machinery will be required in connection with the proposed additions and improvements to the local water supply and sewerage systems. Bonds have been voted by the citizens for $1,401,000 and $1,341,000 for the work, covering water and sewerage systems, respectively. The Board of Public Works will be in charge of the project.

Pittsburgh, Pa.—In connection with its new electric generating plant at Springdale, estimated to cost about $5,000,000, the West Penn Power Co., Pittsburgh, has developed plans for mining coal under the Allegheny river at this point. As the coal is mined and removed, the shaft will be ribbed and converted into a two-track railroad tube, and extending from one side of the river to the other. In this manner, the coal will be transported from the Westmoreland County side of the stream to the Springdale plant, where it will be utilized and stored.

Hagerstown, Md. — Union Bridge Electric & Manufacturing Co. is planning for the extension of its lines to New Windsor, Taneytown, Legore, Key Mar, Middleburg, New Midway and other places in this district. At Legore, the company will connect with the system of the Hagerstown & Frederick Railway Co. Electric service is now being furnished to Union Bridge and Linwood. Clarence Easterday is president.

Indian Head, Md.—The Bureau of Yards and Docks, Washington, has awarded a contract to Levering & Gerrigues, 553 West 23rd street, New York, for the building to house its proposed power plant at the Government works at this place.

Charleston, W. Va. — The State Board of Control has completed plans for the construction of a new one-story and basement power plant at the State Institution, Institute, W. Va. H. Russ Warne, Masonic Temple, Charleston, is architect.

Wierton, W. Va. — Wierton Steel Co. has awarded contracts to the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., and the General Electric Co., Schenectady, N. Y., for electrical machinery and equipment for its proposed steel plant. The orders are said to aggregate $1,000,000.

Walnut Cove, N. C. — Piedmont Power Co., recently organized, is planning for the construction of a new electric transmission line to Winston-Salem. The company will furnish electric light and power service to Walnut Cove and Walkerstown.

Johnston, S. C. — Boyd utilities plant, F. M. Boyd owner, will install a 75-kv-a., 2300-volt alternator driven by internal combustion engine.

Lockhart, S. C.—Lockhart Power Co. will build a new one-story power plant, about 35x160 ft. The Hardaway Contracting Co., Columbus Ga., has received the contract for the building.

Orangeburg, S. C.—City will vote on issuance of $75,000 of bonds for enlarging the electric light plant and installing new machinery. E. Hawes, city engineer.

Cedartown, Ga.—Cedartown Cotton & Export Co. is building a $40,000 addition to its cotton products plant and will expend $125,000 for new machinery. An additional electric power plant is also to be erected.

Hayesville, Ga. — The Public Service Co. is in the market for electrical equipment for a hydroelectric plant and six transmission systems.

Springfield, Ga.—A municipal electric plant may be established.

Pensacola, Fla.—The contract for the construction and equipment of a 5000-ton drydock of the Crandall type has been let to the Aberthaw Construction Co. of Boston. The new drydock was designed by the Crandall Engineering Co. of East Boston, Mass., and consists of five floating pontoons, each 100x40 ft. and 10 ft. deep and costs approximately $450,000. Each of the five pontoons will be equipped with four submerged electric centrifugal pumps designed to empty the dock in one hour. The dock, which is being built for the Emergency Fleet Corp., will be used largely for government work when completed.

NORTH CENTRAL STATES.

Ashland, Oho.—Henry L. Doherty & Co. plan to install a 10,000-kw. tur-

bine at the company's power station near Mansfield, Ohio.

Chillicothe, Ohio. — McVicker & Evans will erect a $150,000 paper mill Specifications include electric lighting.

Cleveland, Ohio. — Drew Electric & Manufacturing Co. has purchased a two-acre tract, on which it proposes to erect a plant at an estimated cost of $50,000 to include a machine shop and brass foundry. James H. Drew, president.

Lima, Ohio. — Ohio Electric Co. plans the erection of a new lighting and power plant. J. E. Dugan is general manager.

Lima, Ohio.—The question of issuing $100,000 bonds for municipal light plant will be submitted to voters. The plans as outlined in the report is for the city to install 600 lights of 400 cp., erecting its own poles and wires. With the equipment placed the city would then ask for bids on current from both the Ohio electric and water works plant.

Lima, Ohio—Lima Locomotive Works will spend $125,000, to build its own electrical plant as an aid to supply additional power if the Ohio Electric Co. does not proceed with its plans to double capacity of the local power plant. Address city clerk.

Oxford, Ohio.—Oxford will give up its municipal lighting plant after 30 years' operation. The town has received a bid from the Ohio Gas & Electric Co., Middletown. This company will erect a transmission line and will supply current under a franchise from the town. The proceeds of the sale of the light and power plant will be used for the purpose of rehabilitating and electrifying the municipal waterworks.

Indianapolis, Ind. — Springer McComas Grain Co. will erect concrete transfer elevator, capacity 25 cars, 177 ft. high, to cost $60,000, exclusive of ground. The company will install two grain dryers and one cleaner.

LaPorte, Ind. — Advance-Rumely Co. will erect new storage shed, 1000 x125 ft.; three two-story additions to the machine shop, one 20x187 ft., one 20x300 ft., and one 20x160 ft. The case-hardening and heat-testing departments will be enlarged by the erection of an addition, 30x40 ft. Improvements will also be made in the powerhouse.

Peru, Ind.—Modern Refrigerator Co. will erect two large buildings at its plant and will increase its capital stock from $25,000 to $100,000.

Shelbyville, Ind.—Universal Electric Co. has received a contract to wire Johnson county infirmary on its bid of $689.38, in order that an electric lighting plant can later be installed.

Arcola, Ill.—A company is being organized to establish a local light plant. Address Collins Brothers.

Charleston, Ill.—Coles County Telephone & Telegraph Co. will place all its wires underground at an estimated cost of $57,000.

Columbia, Ill.—An election to vote $16,000 bonds to extend and improve the municipal light plant carried.

Decatur, Ill.—The Illinois Traction System plans to erect a $2,000,000 power plant on the Sangamon river near Faries Park and the Wabash bridge on the way to Decatur. The plant will furnish power for Illinois Traction System interurbans and arrangements will be made for the transmission of power to Decatur. The present power plant at Cerro Gordo and Edwards street, Decatur, will be abandoned.

Dwight, Ill.—The mayor of this city and the members of the light and water committee of the Council have made a trip to Joliet, Ill., to study the lighting system of that city. The Public Service Co. of Northern Illinois has made a proposal to furnish lighting for Dwight and also for the use of electricity for pumping the city water supply.

Plato Center, Ill.—Board of education plans erection of township high school, 110 ft. x 100 ft. brick to cost $50,000.

Raritan, Ill.—A fund of $2500 has been raised by public subscription as bonus for the promotion of the enterprise for electric lights for Raritan. John K. Barry, president.

Springfield, Ill. — The mayor and city commissioners planned for a $400,000 bond issue to improve and complete the city electric light and power plant. That the light department will be amply able to take care of the payments is assured by commissioner Willis J. Spaulding.

Urbana, Ill.—The Urbana board of local improvements passed a resolution providing for the southwest ornamental lighting system, which provides for the new system of boulevard and West Race streets.

Urbana, Ill.—J. W. Swartz Electric Co. has secured the contract for the electrical work on the new building of the Transport Truck Co., Mount Pleasant, Mich.

Woodstock, Ill.—The City Council has contracted for a new unit for the municipal electric plant. It will be necessary to build an addition to the plant, estimated to cost $25,000.

Bay City, Mich.—Handy Brothers plan the extension within the next year or so of the Detroit, Bay City & Western Railway from Marine City into Detroit.

Verona, Mich.—Union Steam Pump Co. is erecting a machine shop, 150x 200 ft. The first unit of the proposed plant will cost about $500,000.

Chetek, Wis. — Agitation for a municipally owned light and power system has resulted in a proposition from the Chetek Light & Power Co. for sale of distribution system to the city for $9000. The question of purchasing the system and bonding the city will be submitted to voters next month.

Hortonville, Wis.—The village of Hortonville, which has been without street lighting since its gas plant was abandoned will be lighted with electricity furnished by the Wisconsin Traction Light, Heat & Power Co. The traction company will extend its lines to Dale, Medina and Sherwood. Nearly all farmers living along the lines have agreed to purchase current for lighting and power purposes.

Dubuque, Iowa—Dubuque Casket Co. will erect a new $30,000 factory building.

Waverly Iowa. — High school board of education plans the erection of a $200,000 high school.

St. Louis, Mo. — Bell Telephone Co., Broadway & Oliver streets, will build a $30,000 addition to plant.

Omaha, Neb.—Herring Motor Co., Des Moines, Iowa, will erect a plant for handling Fordson tractors and parts.

Wahoo, Neb.—Wahoo Produce Co., will erect a modern produce and cold storage plant, 66x120 ft., to cost $40,000.

SOUTH CENTRAL STATES.

Louisville, Ky. — The Commercial Department of the Louisville Gas & Electric Co. during the week ended July 5, secured 45 new electric light and power customers with 17 kw. of lighting load and 382 hp. in motors. The net gain in business connected for the week was 54 customers with 55 kw. of lighting and 19 hp. in motors. Electric energy output for the week was 9.7% greater than for the corresponding week of 1918.

Texarkana, Ark.—Texarkana Telephone Co. will make extensive improvements. About $60,000 will be expended. Address the mayor.

Albany, Ala.—Alabama Power Co. has been granted a 30-year franchise by the City Council to take effect upon the completion of the new hydroelectric line from the Coosa river. It is estimated the line will be completed early in January. It will provide ample power for all industrial needs in the vicinity.

Montgomery, Ala.—Alabama-Georgia Syrup Co. will erect a $50,000 addition to plant. Conveyor systems will be used throughout all products being handled into and out of cars by the conveyors. Electric elevators and other modern devices for the expeditious handling of the immense business of this plant will be installed.

Union, Ala.—The City Council has arranged for the issuance of bonds for $10,000 to provide for improvements and extensions in the municipal electric plant.

New Orleans, La.—The erection of a central power house on the Mississippi river is planned by the U. S. Naval Station. The estimated cost is $120,000. Engineering Department of the U. S. Navy, Algiers Station, engineers.

Duncan, Miss.—The city will vote Aug. 5 on the issuance of $12,000 of bonds for extending electric light and waterworks systems. Address C. W. Erwin, mayor.

Natchez, Miss.—Improvements and additions are being made to the plant of the National Box Co., representing an investment of over $2,000,000. An electric plant is being installed and it is planned to operate all machinery electrically.

Ruleville, Miss.—The city will issue

$40,000 of electric light plant and street improvement bonds. R. S. Parker, city clerk.

Chelsea, Okla.—At a recent election bonds to the amount of $30,000 were authorized for a water and light plant.

Comanche, Okla. — Bonds to the amount of $35,000 have been voted for the water and electric plant. Address the mayor.

Enid, Okla.—City Ice Co. will improve its plant. J. C. Calhoun has been engaged to prepare plans for a complete new high-speed motor-driven machine with ice tanks of a capacity of 30 tons daily which will make the total capacity of this plant 40 tons per day. Necessary additions to be building will be commenced as soon as plans are completed.

Okemah, Okla. — An election will be held to vote on the question of issuing $50,000 extension and improvements of electric light plant. Address mayor.

Oklahoma City, Okla.—State Board of Affairs will erect a power house and laundry. N. T. Hardin, architect, Equity building, Muskogee, Okla.

Sapulpa, Okla. — Sapulpa Refining Co. has announced improvements to its local plant to cost in the neighborhood of $1,000,000. The Sapulpa Electric Co. has been asked to furnish current for operating 225 hp. in motors, more than one-half of which will operate continuously.

Burkburnett, Tex. — William L. Sonntag, of Wichita Falls, and associates are promoting the construction of an interurban electric railway between Burkburnett and that city. The preliminary arrangements in the matter of financing the project have been made. The line will be about 18 miles long, and will, it is expected, relieve the congestion of passenger traffic between two towns caused by the unprecedented oil development operations.

Corpus Christi, Tex.—Upon application of the Merchants Union Trust Co. of Philadelphia, Pa., the Federal court here has placed the Corpus Christi Railway & Light Co. in the hands of a receiver. C. U. Culberson of Houston was appointed receiver. The company owns the street railway system and electric light and power plant here. Improvements will be made to the property as soon as the sanction of the court for same is obtained.

Houston, Tex.—Houston Lighting & Power Co. will install additional generators and other equipment in its electric power station here and extend its power transmission system. The proposed improvements will cost about $500,000. S R. Bertron, Jr., is general manager.

Mexia, Tex.—The City Council is considering the erection of a municipal electric light and power plant to cost about $150,000.

San Antonio, Tex.—San Antonio Public Service Co. has adopted plans for installing a new steam turbine of a capacity of about 13,000 hp. at its power house on Conception avenue. The improvement will cost about $275,000.

Sherman, Tex.—The city proposes to build and equip an electric light and power plant to cost about $500,000.

Temple, Tex.—O. A. Ryfle of Houston, and associates who are promoting the construction of an interurban electric railway between Temple and Waco expect to have the surveys finished and right of way obtained so that construction may be started about Sept. 15. Committees of citizens have been appointed here and in towns on the route of the proposed line to assist in the preliminary plans for the project. The road will be about 35 miles long.

WESTERN STATES.

Missoula, Mont.—Improvements to cost $80,000 have been started by the Missoula Light & Water Co. at Bonner Dam.

Boise, Idaho. — Idaho Power Co. plans the erection of a transmission line from American Falls to Pocatello, a distance of 25 miles. The company is now installing a 3600-kv-a. generating unit at its lower Salmon hydroelectric plant.

Boise, Idaho. — Mackay Light & Power Co. will extend its lines down the Lost River to Arco.

Seattle, Wash.—Providing for the improvements and additions to the city's Lake Union steam power plant urged by J. D. Ross, superintendent of lighting, an ordinance appropriating $1,250,000 for the work was introduced into the City Council and referred to the utilities committee. The ordinance will be passed and work on the steam plant rushed.

Seattle, Wash. — Electric lighting fixtures estimated to cost $10,000 are to be installed in some of the present school buildings.

Marshfield, Ore.—An estimate of what it will cost to put the power plant at the Smith mill in good running order, in relation to both the part which supplies power for the Mountain States Power Co. and the part which furnishes power for the Smith mill, has been completed by the consulting engineer of the power company, to cost $60,000.

Portland, Ore. — Franks Laundry Co. will erect a $50,000 laundry at East 7th & Pine streets to be operated by electricity.

Porterville, Cal.—The City Council has under advisement plans for the establishment of a municipal electric light plant.

PROPOSALS

Lighting System.—Bids will be received until 8 p. m., July 28 by Black & Veatch, engineers, 507 Interstate building, Kansas City, Mo., for a lighting system at Osawatomie, Kans.

Centrifugal Pumps.—Bids will be received at the office of the director of public service, Delaware building, Akron, Ohio, until Aug. 1, for furnishing two horizontal centrifugal pumps, normal capacity 1000 gal. per minute against a total head of 80 ft. direct connected to electric motors. Specifications may be obtained from the Bureau of Waterworks Improvement, 102 East Mill street, Akron. G. G. Dixon, engineer; H. H. Frost, superintendent of waterworks.

Motor-Driven Triplex Pump.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 8, for a new motor-driven triplex pump, etc., in the United States post office and custom house at Cairo, Ill.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Machinery (30,004).—The agency for the sale of building materials, hardware, domestic and general, motor accessories, and electrical machinery and fittings is desired by a man in England. References.

Electrical Apparatus (29,964).—A firm in Australia wishes to get in communication with American exporters of electrical wires, cables, conduits, machinery, lamps, fittings, and glassware, metals and metal products, machinery for all industrial purposes, hardware, plate glass, sheet glass, lumber, oils, chemicals, paper, textiles, canned goods, automobiles and accessories.

Electrical Aerial Trolley System (29,966).—An electrical aerial trolley system to carry passengers between mountain top is desired by a company in Portugal. Quotations should be given c. i. f. Portuguese port. Payment, credit in New York. Correspondence may be in English. References.

Electric Motors (29,967).—A company in India desires to purchase complete paint manufacturing machinery with output of 10 tons per day, a portion of which will be enamels, oxides and ochres. Electric motors should be supplied with large machines. Quotations should be given c. i. f. Indian port. Payment in the United States against documents. References.

INCORPORATIONS

New York, N. Y.—Metricappliance Corp. Capital, $20,000. To manufacture electric meters. Incorporators: A. W. Franklin, M. B. and D. B. Kassel, 47 West 112th street.

New York, N. Y.—Universal Condenser. Capital, $100,000. To manufacture condensors and kindred equipment. Incorporators: P. G. Chichester, Brooklyn; E. Nolan, and D. T. Howell, 945 East 180th street, New York.

Personal

C. H. Howell Elected President Ohio Electric Light Association—V. R. Lansingh President of Lunken Window Co.

W. S. ROBERTSON, who has been connected with the Nebraska Power Co. for about two years, has been appointed assistant general manager in charge of operation. He will have charge of all the operating departments of the company.

WILLIAM PETSCHEL, electrical engineer and storage battery expert, formerly president and manager of the Atlas Electric Storage Battery Co., Greenville, Mich., is now general manager and vice-president of the Vulcan Storage Battery Co., Brazil, Ind.

JOHN GILLESPIE, formerly affiliated with the steel casting department of the Midvale Steel & Ordnance Corp., has accepted the appointment of general superintendent of the Philadelphia Electric Steel Corp., Conshohocken, Pa., succeeding Arthur S. Breithaupt.

RAYMOND G. SHERMAN, superintendent of the Deerfield River Power Co., has been appointed superintendent of the Connecticut River Power Co. of New Hampshire, Brattleboro, Vt., both of which concerns are under the management of the New England Power Co., with headquarters at Worcester, Mass.

TERENCE FARLEY, New York, has been appointed general counsel to the Public Service Commission, New York, by Commissioner Lewis Nixon, to succeed Godfrey Goldmark, recently resigned. Mr. Farley has been an assistant corporation counsel for 27 years, and for the last 12 years has been at the head of the Appeal Bureau of that office.

GEORGE W. HUBLEY, who recently terminated his office as administrative engineer and chief of conservation of the United States Fuel Administration of Kentucky, has opened an office in Louisville as a consulting and advisory engineer and also to furnish service as a power plant specialist. Mr. Hubley was previously general manager of the Badenhausen Co. of Philadelphia and New York City, prior to which time he was general manager and chief engineer of the Merchants' Heat & Light Co. of Indianapolis, Ind.

H. M. TURNER has been made assistant professor of electrical engineering in the Sheffield Scientific School of Yale University. Professor Turner was graduated from the University of Illinois and for several years has been in the Electrical Engineering Department of the University of Minnesota. He went to Yale last fall as assistant professor of radio and advanced electrophysics and directed the field radio work of the Signal Corps Training School for officer candidates. Since its disbanding his work has been in the Electrical Engineering Department, in which department he is now continued.

VAN RENSSELAER LANSINGH, formerly general manager and chief engineer of the Holophane Works of the General Electric Co., Cleveland, and later manager of the Holophane Sales Department of the National Lamp Works of General Electric Co., Nela Park, Cleveland, has been elected president of The Lunken Window Co., Cincinnati, Ohio. This company manufactures a unit window consisting of window frame, disappearing sash and fly-screens. The upper and lower sash telescope into a window box above the usual window opening, making it possible to secure maximum ventilation from the entire window opening at the same time screening from top to bottom.

Van Rensselaer Lansingh.

Mr. Lansingh entered the University of Chicago in 1892, graduated January, 1896. From February, 1896, to June, 1898, he attended the Massachusetts Institute of Technology, receiving the degree of Bachelor of Science in electrical engineering. In February, 1899, he entered the testing department of the Western Electric Co. with whom he remained until July, 1900, when he formed the V. R. Lansingh Co. in Chicago, sales agent for Holophane reflectors. In September, 1904, he was appointed general manager and chief engineer of the Holophane Works of General Electric Co. and in March, 1914, became manager of the Holophane Sales Department of the National Lamp Works.

In August, 1914, Mr. Lansingh resigned that position to start in Chicago The Hardware Buyers Association, which later became the By-Lo Stores Co., operating a chain of hardware stores at Muncie, Frankfort and Anderson, Ind. The advent of our entering into the world war prevented the expansion of this chain and consequently, in March, 1917, he entered as a volunteer in the Council of National Defense at Washington, D. C., serving under Dr. Hollis Godfrey, one of the advisories of this Council. He continued work along different engineering lines until June, 1917, when he sailed for France to represent the Massachusetts Institute of Technology, which was later consolidated with the American Universities Union in Europe with headquarters in Paris and with branches in England and Rome. For a year he served as a director of the Technology Bureau in the Union and also as business manager and assistant director of the organization, whose purpose it was to serve college men and friends in service abroad and to promote closer relationship between American and foreign universities. In July, 1918, he returned to the States and in October was placed by the Government in the Metz Plant at Waltham, Mass., as works manager in the plant manufacturing airplanes for the Government. He continued in this capacity until April, 1919, and in June became president of The Lunken Window Co., Cincinnati, Ohio. Mr. Lansingh has been prominent in the activities of the Illuminating Engineering Society, having been its general secretary in 1906 and president for the term ending in December, 1912. He has also served the society in other offices and on committees, and has been closely identified with the advancement of scientific principles concerning the use of reflectors of light sources. In collaboration with J. R. Cravath he wrote a book, "Practical Illumination," which has had a very wide circulation and is not only in the library of every man interested in lighting, but has been used extensively as a text book in many educational institutions.

FRANKLIN T. GRIFFITH, president of the Portland Railway, Light & Power Co., Portland, Ore., and C. M. Clark, chairman of the board of directors of that company, of Philadelphia, recently made a 5-days' trip on horseback over the headwater-region of the Clackamas river, on the western slope of the Cascade mountains. Their trip was to look over sites for possible hydroelectric development. This is undoubtedly in anticipation of greatly increasing power demands within the next few years.

E. H. WADDINGTON, president of the St. Louis Electrical Board of Trade and western district manager of the Pole and Line Material Department, Western Electric Co., met with a serious accident recently while on a tour of inspection in the West. While engaged in the work of inspection at the company's pole yards at Spirit Lake, Idaho, he was caught in a slide of poles and had his left leg broken below the knee. An X-ray revealed the injury to be two fractures near the joint. He will be confined to his home for several weeks. Mr. Waddington has been actively connected with the St. Louis Jovian League for a number of years and was a mem-

ber of the committee that formulated the plan for its reorganization into the St. Louis Electrical Board of Trade. He has a host of friends who sympathize deeply with him in his misfortune.

ARTHUR E. ANDERSON, formerly chief engineer of the Intermountain Railway, Light & Power Co., Denver, Colo., has assumed the position of general superintendent of the Grand Junction Electric, Gas & Manufacturing Co., and the Grand River Valley Railway Co., Grand Junction, Colo.

LANDERGREN ARMSTRONG, for the last three years publicity manager for the Crouse-Hinds Co., Syracuse, N. Y., has associated himself in a similar capacity with the Brown-Lipe Gear Co., of the same city, the pioneer manufacturer of transmissions, clutches and control sets for pleasure cars and auto trucks. Mr. Armstrong was a member of the Crouse-Hinds organization for ten years, during the first seven years of which he served as assistant publicity manager. Prior to that connection, he occupied an editorial position with the New York News Bureau of New York City.

B. F. TUCKER, manager of operations for the Central Illinois Public Service Co., with headquarters at Mattoon, Ill., has resigned that position to become manager of a 1225-acre farm near Peoria, owned by himself and two associates. Mr. Tucker was one of the owners of the electric lighting plant at Virden, Ill., until it was taken over by the Central Illinois Public Service Co. He then entered the service of this company at Taylorville, Ill., taking the position of district superintendent. He was later transferred to Mattoon, where he became assistant general superintendent and in February, 1915, was appointed general superintendent and in January, 1919, became manager of operations. Mr. Tucker has also been deeply interested in agricultural operations for a number of years and will take up farming on a large scale. He will apply mechanical power as far as possible to farm operations.

DR. V. BUSH, engineer of the American Radio & Research Co., has been appointed associate professor of Electrical Engineering at the Massachusetts Institute of Technology. Dr. Bush is a graduate of the Electrical Engineering course of Tufts College and received an M. S. degree from that college in 1914. He received the degree of Doctor of Engineering from the Massachusetts Institute of Technology in 1916. After graduating from Tufts he had been an instructor on its staff with a notable record as a teacher and was later made an assistant professor. During the course of scientific researches in the war, Dr. Bush was associated with the New London researches of the United States Navy for the detection of submarines and did distinguished service in that work. The doctor's thesis which he presented at the Massachusetts Institute of Technology will be remembered by electrical engineers from a paper read before the midwinter convention of the A. I. E. E. in February, 1917, entitled "Oscillating Current Circuits by the Method of Generalized Angular Velocities," in which a discussion is given of the "threshhold impedances." In his new position, Dr. Bush will take up a portion of the instruction to undergraduate students heretofore given by Professor Wickenden, who recently resigned to go permanently into the service of the Western Electric Co. In addition Dr. Bush will give a course of advanced lectures to postgraduate students and devote the remainder of his time to research.

C. H. HOWELL, newly elected president of the Ohio Electric Light Association, is vice-president of The Ohio Service Co., Coshocton, Ohio. He was graduated from Richmond College, Richmond, Va., in June, 1905, with the degree of Bachelor of Science, and immediately thereafter accepted a position as car barn foreman with the Newport News & Old Town Street Railway Co. at Hampton, Va. In January, 1906, he entered the student course of the General Electric Co. at Lynn, Mass., and coincident with this work in 1906-1907 took post graduate work in thermodynamics and electrical engineering at the Massachusetts Institute of Technology. In 1908 Mr. Howell entered the student course of the General Electric Co. at Schenectady, N. Y., and in 1909 entered sales work as commercial engineer in the power and mining and small motor department of the General Electric Co., Pittsburgh. He pursued this work until August, 1912, when he accepted the position of manager of the Coshocton Light & Heating Co., Coshocton, Ohio. In January, 1913, jointly with this position, he took the managership of the New Midland Power & Traction Co., Cambridge, Ohio, and in May of the same year took a similar position with the County Electric Co. at New Philadelphia and Dennison, Ohio, and the Twin City Traction Co. at Dennison, Ohio, and the Tuscarawas County Light, Heat & Power Co., New Philadelphia. Also during the year 1913 he was appointed manager of the Lafayette Light & Power Co., Strasburg, Ohio. All of these companies, including the Strasburg Electric Co., Strasburg, the Newcomerstown Light, Heat & Power Co., Newcomerstown, were later merged into a single corporation, which is now known as The Ohio Service Co.

C. H. Howell.

Under Mr. Howell's directorship the company since 1914 has constructed over 111 miles of 33,000-volt transmission lines, connecting all the above towns, some 21 miles of 13,000-volt power feeders, and two new power houses. The company is now operating in 26 different communities scattered over four counties; two railway systems; two central district heating systems and two hydroelectric plants. Since 1914 the revenue of The Ohio Service Co. has grown more than 100% and the number of customers connected to its lines since the beginning of 1916 has increased 77%. Mr. Howell was one of the first among those who appreciated the possibilities of selling utility stock to customers and residents in the territory served by the utility. Today he is reaping the benefit of this for his policy has been prosecuted most successfully. He is a member of the American Institute of Electrical Engineers, American Electrochemical Society, the Boards of Trade of Coshocton, Cambridge, Dennison, Uhrichsville, New Philadelphia and Dover, and is a director in the Coshocton Board of Trade, a Rotarian at Coshocton, and for a number of years has been a member of the executive committee of the Ohio Electric Light Association.

G. F. WITTIG has been appointed assistant professor of Electrical Engineering in the Sheffield Scientific School of Yale University. He has been at Yale during the past year, first in connection with the Signal Corps Training School for officer candidates and after its disbanding has been a member of the Physics Department. Professor Wittig received his degree at Columbia. He was associated for a time with the Westinghouse, Church, Kerr Co. and assisted A. V. Abbot in the revision of his book on "Electrical Transmission of Energy." He was for several years head of the Department of Electrical Engineering and Physics at the University of Alabama and was later assistant professor of Electrical Engineering at the University of Pennsylvania. During last summer he was associated with the Radio Division of the Bureau of Standards and was co-author of the book on radio written by the Bureau of Standards which has appeared as Pamphlet No. 40. In the summer of 1917 he was division engineer in the construction of Camp McClellan.

OBITUARY.

OSCAR OTTO, general superintendent of the South Philadelphia Machine Works of the Westinghouse Electric & Manufacturing Co., died at his home on June 30 as a result of fatal injuries received in an automobile accident on the previous Friday morning, while driving his car up a steep grade near Westgrove, Pa., where he met an army truck-train which was descending the hill. One of the trucks skidded, sideswiped his car and completely demolished it. Mr. Otto was born in Manitowoc, Wis., on Jan. 2, 1858. After finishing his apprenticeship course as a machinist in the Manitowoc shops of the Chicago & Northwestern Railway, and later serving several years at various places in the state of Wisconsin, he accepted a position with the Northern Pacific Railroad Co. at Tacoma, Wash., going from there to the Oregon Short Line at Salt Lake City. In 1898 he returned to the Chicago & Northwestern Railroad as superintendent of its Chicago shops, continuing in this position until June, 1909, when he was appointed superintendent of the Westinghouse Machine Works at East Pittsburgh. When the Westinghouse company opened its new plant at Essington Mr. Otto supervised the installation of the machinery, and later, in February, 1918, he was permanently transferred to the new works, where he remained until his death. The deceased is survived by his widow, a daughter and three brothers.

Financial News

Mexican International Corporation Formed.

Interest in Mexico as a field for future development and financing is evidenced in the announcement made July 15 of the organization of the Mexican International Corp. by a group which includes officers of important banking and business houses.

This corporation has been organized under the laws of the State of Delaware and officers will be maintained both in New York City and in Mexico City. Its purposes are set forth as: (1) the investigation of existing enterprises to determine their physical and financial condition, management and future prospects and the development therefrom of plans for refinancing and extension which will procure for the corporation an interest in the enterprise; (2) the investigation of proposed enterprises to determine their merit, probable cost and future prospects, and the development therefrom of plans for the financing, construction, management and ultimate disposition of the enterprise; (3) the investment in, underwriting and organization of underwriting syndicates for the development and operation of such enterprises in Mexico as may be approved by the corporation. Should developments indicate the necessity therefor, the corporation will establish a service department to furnish information and service of a character in keeping with its purposes.

The officers of the corporation will be: President, Thomas H. Gillespie, president of T. A. Gillespie Co.; vice-presidents, George J. McCarty, president of the Mercantile Banking Co., Ltd., of Mexico City, and H. S. Brown. Mr. McCarty will be in charge of the corporation's offices and organization in Mexico City.

Mr. Brown will be in charge of the corporation's offices and organization in New York City. He has had 17 years' experience in financial work in New York City and has spent considerable time in Mexico. During the war he was chief of the Finance Division of the Bureau of Aircraft Production in Washington and after the signing of the armistice became an assistant to the United States Liquidation Commission in Paris.

The capital stock of the corporation will be divided into two classes. There will be 10,000 shares of preferred 7% cumulative stock of the par value of $100 and 25,000 shares of common stock with a par value of $5. Both classes of the stock will be subscribed for in cash at par, 25% of the subscription being immediately payable and the remaining 75% being payable in whole or in part at such time as the directors may determine. Subscribers to the preferred stock will have the right to subscribe to an equal number of shares of the common stock.

In announcing the organization of the corporation, Harvey D. Gibson and Grayson M. P. Murphy, the syndicate managers, made the following statement:

"For the United States the course of Mexican affairs is particularly vital and if properly followed should offer unusual opportunities. Not only is Mexico so located as to afford a natural field for investment and development by our people, but she has unexploited natural resources, the mere scratching of which would provide the means to clear off all her national debt and place her on a sound financial basis. With a soil capable of producing all the cereal crops and 90% of all the known fruits of the world, with vast tracts of timber, including many varieties of precious hardwoods and dyewoods, with a wide range of climate, with every known mineral, and with oil fields which exported more than 63,000,000 barrels in 1918, Mexico needs only a return to normal conditions and the introduction of modern methods and modern machinery to bring her quickly into the front rank of the producing world."

Duquesne Light Bond Issue.

The Duquesne Light Co. has sold to a syndicate of New York bankers, comprising Harris, Forbes & Co., Ladenburg, Thalmann & Co., and Lee, Higginson & Co., $25,000,000 first mortgage, 30-year 6% gold bonds to be sold at par. The sale of these bonds will assure the erection without delay of the large electric power plant at Cheswick, which will guarantee all power needs of the Pittsburgh district for the future.

The company owns and controls in large part, directly operates properties, conducting the entire central station, electric light and power company business in Pittsburgh and throughout the major portions of Allegheny and Beaver counties in Pennsylvania. It controls a single interconnecting system which serves a total estimated population of 1,100,000 people. The net earnings of the company for the year ended April 30 were over two and one-half times the fixed charges including interest on the present bonds.

Dallas Power & Light Bond Issue.

An offering of $4,500,000 first mortgage 6% gold bonds is being made by Lee, Higginson & Co., and the Harris Trust and Savings Bank, Chicago, at 100 and interest, yielding 6%. They are dated July 1, 1919, and become due July 1, 1949, principal and interest being payable in Boston or New York. The bonds will be secured by a direct first mortgage on all properties and franchises of the company. The company will have no other funded debt upon completion of the present financing. The Dallas Power & Light Co. acquired by purchase on Sept. 29, 1917, all the properties of the Dallas Electric Light & Power Co., which has been conducting an electric light and power business in Dallas, Texas, for 16 years. The company does substantially all the electric light and power business in Dallas. The new franchise approved by popular vote of the city on April 3, 1917, established a definite "property value" now amounting to about $6,200,000, against which, the mortgage provides, not exceeding $5,000,000 of these bonds may be issued, including the $4,500,000 now offered. Under the new franchise the company is now authorized to reserve out of net earnings, as a first charge, 9% on the "properly value." On $6,200,000, this 9% amounts to $558,000, or more than twice the $270,000 annual interest on these $4,500,000 first mortgage bonds.

Indiana Utility Commission Orders.

The Public Service Commission of Indiana, in a recent conference at which a number of orders were passed, authorized the Interstate Public Service Co. to buy the Indianapolis & Louisville Traction Co. This gives the Interstate Co. a direct line by actual ownership or leases from Indianapolis to Louisville.

The Interstate company acquires the I. & L. by paying $330,000 for the capital stock of the company and by assuming the $846,300 bonded indebtedness. The I. & L. property, consisting of 41 miles of interurban track between Seymour and Sellersburg, figured in the deal at $28,700 a mile or a total of $1,176,300, which is covered by the purchase price and the bonded indebtedness. The commission authorized the Interstate company to issue 31,200 bonds to retire a part of the $846,000 bonded indebtedness.

The commission authorized the Northern Indiana Gas & Electric Co. to issue $1,906,000 10-year, 7% notes at par. The notes are designated to take up $955,300 demand 6% notes issued by the company and to take up $950,855 of an open 8½% account with its holding company, the United Gas & Improvement Co. The new note issue will reduce the fixed charges of the company $4720 annually.

The commission directed the Brazil Gas Co. and the Terre Haute, Indianapolis & Eastern Traction Co. to make physical changes in their Brazil properties to prevent electrolysis of the gas company's mains because of escaping current from the traction company wires.

American Interests Ask Concessions in Mexico.

Applications filed by American and other foreign investment interests for concessions for the construction of electric and steam railroads and various other kind of industrial enterprises are now pending with the Department of Communication and Public Works of the Mexican government. It is indicated by the attitude of the Carranza administration toward outside capital that these applications may all be rejected. The government has already adopted the policy of not granting any new concessions for the construction of additional lines of steam railroad. It has announced its intention of doing on its own account whatever railroad building may be deemed necessary, adding such lines to the National Railways of Mexico. Recently application was filed with the Department of Communications and Public Works for a concession to construct an electric interurban railway through the oil fields of the Gulf Coast region, connecting Tampico and Tuxpan. The proposed line would be about 120 miles long. No action has as yet been taken upon this application.

Dividends.

Carolina Power & Light Co. has declared a quarterly dividend of 1% on common stock, payable Aug. 1 to stock of record July 15.

Directors of the Connecticut Railway & Lighting Co. have declared a quarterly dividend of 1⅛% on common and preferred stock, both payable Aug. 15 to stockholders of record Aug. 1.

Duquesne Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Aug. 1 to stock of record July 1.

Railway & Light Securities Co. has declared dividends of 3% on both common and preferred stock, both payable Aug. 1 to stock of record July 15.

The board of directors of the Texas Electric Railway Co. has declared a quarterly dividend of 1¾% on second preferred stock, payable Aug. 1 to stock of record June 30.

West Penn Power Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Aug. 1 to stockholders of record July 21.

West Penn Traction & Water Power Co. has declared a quarterly dividend on preferred stock of 1½%, payable Aug. 15 to stock of record Aug. 1.

Commonwealth Edison Co. has declared a quarterly dividend of 2%, payable Aug. 1 to stock of record July 15.

Edison Electric Illuminating Co. of Boston has declared a quarterly dividend of 3%, payable Aug. 1 to stock of record July 15.

Edison Electric Illuminating Co. of Brockton has declared a quarterly dividend of 2%, payable Aug. 1 to stockholders of record July 21.

Electric Securities Co. has declared a dividend of 1¼% on preferred stock, payable Aug. 1 to stock of record July 22.

Electric Bond & Share Co. has declared a quarterly dividend on preferred stock of 1½%, payable Aug. 1 to stockholders of record July 16.

Illuminating & Power Securities Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Aug. 15 to stock of record July 31.

Lowell Electric Light Co. has declared a quarterly dividend of 2½%, payable Aug. 1 to stock of record July 21.

Westinghouse Electric Export Co., 165 Broadway, has filed notice of an increase in its capital stock from $100,000 to $5,000,000, and a change in its corporate name to the Westinghouse International Co.

For the Readjustment Period—What?

XLVI.

New Conditions in Business

With the signing of the armistice there came in a day a new era in advertising. Never in the history of this important industry has anything occurred so momentous, so far-reaching and so radical.

Many a dormant manufacturing business awoke overnight. Restricted business found itself unbound. War-time business was suddenly forced back into peace-time channels. Boundless new possibilities suddenly loomed into view.

The volume of advertising, as a result, quickly broke all records. Magazines and weeklies jumped to new sizes. Popular newspapers found themselves overwhelmed.

It is also evident that advertising has gained a new effectiveness. Something has brought it new respect and attention.

We attribute this, in part, to war experience with Liberty Loans, war charities, etc. Advertising has never brought such results as today, despite its large increase in volume.

Sales of advertised articles have grown beyond all precedent on long-established lines. Demand has multiplied on some from two to four times over. Nearly every old basis of figuring cost and result is obsolete today.

Doubtless this is due in part to prosperous conditions. But increase in the lines we handle comes not merely from increased demand from old customers; it is mainly from gaining new customers. Advertising is gaining customers for our clients faster and more cheaply than ever before in our history.

Facts such as these show that advertising has gained new recognition. Whatever its old-time importance in business, it is twice as important now. And it never was so profitable.

LORD & THOMAS, Chicago.

This extract from a summary prepared by a large and extremely competent advertising agency reflects present conditions with absolute accuracy. It is worthy the attention of leaders in industry.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Earnings.

GALVESTON-HOUSTON ELECTRIC CO.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 248,596	$ 66,983	$ 31,346
12 mos. ended May 31, 1919	2,898,993	815,628	443,203

EASTERN TEXAS ELECTRIC CO.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 110,108	$ 42,239	$ 29,279
12 mos. ended May 31, 1919	1,235,896	487,622	335,184

MISSISSIPPI RIVER POWER CO.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 198,593	$ 151,421	$ 48,135
12 mos. ended May 31, 1919	2,222,689	1,741,160	497,689

TAMPA ELECTRIC CO.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 103,018	$ 38,873	$ 34,263
12 mos. ended May 31, 1919	1,144,289	467,016	414,133

NORTHERN TEXAS ELECTRIC CO.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 264,547	$ 103,402	$ 78,360
12 mos. ended May 31, 1919	2,904,145	1,093,509	792,831

LOWELL ELECTRIC LIGHT CORP.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 73,757	$ 15,568	$ 13,495
12 mos. ended May 31, 1919	980,606	234,926	213,544

EDISON ELECTRIC ILLUMINATING CO. OF BROCKTON.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 83,444	$ 24,764	$ 18,185
12 mos. ended May 31, 1919	962,546	301,523	222,373

HOUGHTON COUNTY ELECTRIC CO.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 32,239	$ 7,688	$ 4,006
12 mos. ended May 31, 1919	438,105	143,037	99,328

TWIN CITY RAPID TRANSIT.

May—	1919.	1918.
Gross revenue	$ 917,702	$ 804,783
Net revenue	299,166	268,363
Net income	136,454	107,586
From Jan. 1—		
Gross revenue	4,417,828	4,039,141
Net revenue	1,204,117	1,066,419
Net income	412,485	283,951

AMERICAN TELEPHONE & TELEGRAPH.

For five months ended May 31, gross was $17,808,931, an increase of $3,352,324; operating income was $8,483,722, an increase of $1,640,363. For May, gross, $3,801,516, an increase of $823,352; income, $1,776,526, an increase of $471,147.

WESTERN STATES GAS & ELECTRIC CO.

Earnings of the Western States Gas & Electric Co. (Delaware and subsidiaries) for the month of June and 12 months ended June 30, compare with earnings of corresponding previous periods as follows:

	June, 1919.	June, 1918.
Gross	$ 158,558.41	$ 132,944.94
Net	70,185.65	52,424.56
	12 months to 6-30-19.	12 months to 6-30-18.
Gross	$1,756,616.73	$1,512,318.82
Net	707,282.01	653,672.80

COLUMBUS ELECTRIC CO.

	Gross earnings.	Net earnings.	Surplus after charges.
May, 1919	$ 101,646	$ 49,304	$ 19,175
12 mos. ended May 31, 1919	1,190,199	561,880	208,033

DETROIT EDISON CO.

	Month of May, 1919.	Month of May, 1918.	5 Months of 1919.	5 Months of 1918.
Operating Revenue—				
Commercial Electric Revenue	1,003,912.50	866,869.33	5,357,488.93	4,531,901.14
Municipal Electric Revenue	27,869.72	26,283.01	138,976.10	130,062.66
Sales to Street Railways	82,911.08	72,519.46	383,760.57	352,685.96
Sales to other Public Service Corporations	13,737.24	12,214.90	73,481.05	62,542.66
Miscellaneous Revenue	557.42	5,595.58	3,305.67	26,188.31
Non-Operating Revenue—				
Steam Sales	60,998.18	29,959.21	607,326.05	517,011.80
Other Non-Operating Revenue	20,354.04	16,966.53	86,968.15	66,820.55
Total Gross Revenue	1,210,340.18	1,030,408.02	6,651,306.52	5,681,213.08
Expenses—				
Operating and Non-Operating (except Renewal, Replacement and Contingent)	854,739.58	738,475.30	4,471,930.29	3,790,704.93
Renewal, Replacement and Contingent (Depreciation Reserve)	59,990.00	59,990.00	291,275.00	291,275.00
Total Operating and Non-Operating Expenses	914,729.58	798,465.30	4,763,205.29	4,081,979.99
Net Income	295,610.60	231,942.72	1,888,101.23	1,599,233.09
Deductions from Income—				
Interest on Funded and Unfunded Debt	139,504.43	104,902.24	686,681.82	498,297.65
Other Deductions	.....	.....	.....	.....
Total Deductions	139,504.43	104,902.24	686,681.82	498,297.65
Net	156,106.17	127,040.48	1,201,419.41	1,100,935.44

DAYTON POWER & LIGHT CO.

	June, 1919.	June, 1918.	Six months ended June 30, 1919.	Six months ended June 30, 1918.	12 months ended June 30, 1919.	12 months ended June 30, 1918.
Gross earnings	$200,133	$173,606	$1,411,791	$1,121,327	$2,721,192	$2,103,554
Operating expenses (including depreciation and taxes)	126,804	117,294	885,015	794,612	1,752,354	1,450,562
Net earnings	$ 73,329	$ 56,312	$ 526,776	$ 326,715	$ 968,838	$ 652,992
Non-operating revenue	3,497	3,769	16,162	14,404	35,059	20,481
Total income	$ 76,826	$ 60,081	$ 542,938	$ 341,119	$1,003,897	$ 673,473
Interest on bonds	$ 32,113	$ 32,192	$ 192,880	$ 160,360	$ 386,030	$ 251,085
Other deductions (including other interest and sinking fund)	9,597	11,424	61,997	70,504	138,146	133,326
Total deductions	$ 41,710	$ 43,616	$ 254,877	$ 230,864	$ 524,176	$ 384,411
Net income	$ 35,116	$ 16,465	$ 288,061	$ 110,255	$ 479,721	$ 289,062
Dividends on preferred stock	15,997	14,813	93,567	88,875	184,244	177,750
Surplus	$ 19.119	$ 1.652	$ 194.494	$ 21.380	$ 295.477	$ 111.312
Operating ratio	63.36%	67.56%	62.69%	70.86%	64.40%	68.96%

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate Per cent.	Bid July 15.	Bid July 22.
Adirondack Electric Power of Glens Falls, common	6	15½	15
Adirondack Electric Power of Glens Falls, preferred	6	75	76
American Gas & Electric of New York, common	10+extra	132	130
American Gas & Electric of New York, preferred	6	42	41
American Light & Traction of New York, common	..	257	258
American Light & Traction of New York, preferred	6	97	98
American Power & Light of New York, common	4	68	65
American Power & Light of New York, preferred	6	73	73
American Public Utilities of Grand Rapids, common	..	10	10
American Public Utilities of Grand Rapids, preferred	7	38	35
American Telephone & Telegraph of New York	..	103¾	103⅝
American Water Works & Elec. of New York, common	..	5½	5
American Water Works & Elec. of New York, particip	7	11	11
American Water Works & Elec. of New York, first preferred	..	59	59
Appalachian Power, common	..	6	6
Appalachian Power, preferred	7	22	20
Cities Service of New York, common	+extra	440	441
Cities Service of New York, preferred	6	78⅞	78½
Commonwealth Edison of Chicago	8	112	109½
Comm. Power, Railway & Light of Jackson, common	..	28	27
Comm. Power, Railway & Light of Jackson, preferred	6	62	61
Federal Light & Traction of New York, common	..	11	12
Federal Light & Traction of New York, preferred	..	59	50
Illinois Northern Utilities of Dixon	6	70	70
Middle West Utilities of Chicago, common	2+extra	36½	34
Middle West Utilities of Chicago, preferred	6	60	58
Northern States Power of Chicago, common	..	71	69
Northern States Power of Chicago, preferred	ex.div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	66	68
Pacific Gas & Electric of San Francisco, preferred	6	88	89
Public Service of Northern Illinois, Chicago, common	7	89	89
Public Service of Northern Illinois, Chicago, preferred	6	94	94
Republic Railway & Light of Youngstown, common	4	17	16
Republic Railway & Light of Youngstown, preferred	6	57	56
Standard Gas & Electric of Chicago, common	..	37	36
Standard Gas & Electric of Chicago, preferred	6	46	46
Tennessee Railway, Light & Power of Chattanooga, common	..	6½	6
Tennessee Railway, Light & Power of Chattanooga, preferred	6	22	20
United Light & Railways of Grand Rapids, common	4	48	47
United Light & Railways of Grand Rapids, preferred	6	75	74
Western Power of San Francisco, common	..	22	22
Western Union Telegraph of New York	extra	88½	87
Industries.			
Electric Storage of Philadelphia, common	4	94	88½
General Electric of Schenectady	8	171	167¾
Westinghouse Electric & Mfg. of Pittsburgh, common	7	58⅞	56¾